University of Colorado at Boulder

CU - LASP

Project No. CP-121908

3665 DISCOVERY DRIVE, SUITE 100 & 200
BOULDER, COLORADO 80309

ISSUE FOR BID

PROJECT MANUAL
Divisions 01 through 33

BURKETTDESIGN
1899 Wynkoop, Suite 300, Suite 900
Denver, CO 80202

June 16, 2011
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**University of Colorado at Boulder**

**CU - LASP**

**Issue for Bid**

**Division 00 through 33**

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CLIENT
COMPANY University of Colorado
Names Caroline Hines
Address Denver, Colorado
ZIP code 80237
Office Phone
Emails caroline.hines@lasp.colorado.edu

BUILDING OWNER
COMPANY University of Colorado
Names Jeffrey S. Lipton, Director of Real Estate
Address 444 UCB
City/State Boulder, Colorado
ZIP code 80309-0444
Office Phone 303.492.2222
Emails jlipton@colorado.edu

ARCHITECT
COMPANY BURKETTDESIGN
Names Peter Carlson, Registered Architect, Principal
Address 1899 Wynkoop Street, Suite 300
City/State Denver, Colorado
ZIP code 80202
Office Phone 303.256.1133
Emails Peter.Carlson@burkettdesign.com

MECHANICAL/PLUMBING ENGINEER
COMPANY ME-Engineers, Inc.
Names
Address 10055 West 43rd Avenue
City/State Wheat Ridge, Colorado
ZIP Code 80033-2833
Office Phone 303.421.6655
Emails

ELECTRICAL ENGINEER
COMPANY ME-Engineers, Inc.
Names
Address 10055 West 43rd Avenue
City/State Wheat Ridge, Colorado
ZIP Code 80033-2833
Office Phone 303.421.6655
Emails
### FIRE PROTECTION/FIRE ALARM

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<tr>
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<td>Scott Craig</td>
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<tr>
<td>Address</td>
<td>520 Courtney Way, Suite A</td>
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<tr>
<td>City/State</td>
<td>Lafayette, Colorado</td>
</tr>
<tr>
<td>ZIP Code</td>
<td>80026</td>
</tr>
<tr>
<td>Office Phone</td>
<td>303.439.7160</td>
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End of Project Directory
ADVERTISEMENT FOR BIDS
State of Colorado
University of Colorado
Notice Number: 11-14

Project No: CP 121908
Project Title: CU – LASP – Tenant Finish
Estimated Construction Cost: $1,350,000.00
*ARRA Funding?: No

Settlement Notices
For all projects with a total dollar value above $50,000 Notice of Final Settlement is required by C.R.S. 38-26-107.
Final Settlement, if required, will be advertised via: The Daily Journal

Project Description
Tenant finishes, mechanical and electrical work.

Project Information
1. The Principal Representative has determined that the entire project shall be substantially complete within 62 calendar days from the date of the Notice to Proceed, and the project shall be finally complete, including the delivery of any or all guarantees and warranties, the submittal of sales and use tax payment forms, the completion of the final punch list and the calling for final inspection, within 21 calendar days, if applicable, from the date of substantial completion. In accordance with Article 46 of the General Conditions of the Contract, Time of Completion and Liquidated Damages, failure to complete the work within the agreed number of calendar days shall be considered breach of contract and subject the bidder to liquidated damages to the extent specified in Article 54D of the General Conditions of the Contract.

2. The right is reserved to waive informalities or irregularities and to reject any and all Bids.

3. Bidders may procure Bidding Documents from the following website on June 16, 2011 after 10:00 AM.
   http://www.colorado.edu/facilitiesmanagement/pdc/construction/open.html
   There will not be a charge for contract documents downloaded from the website.

4. Each Bid shall be submitted on the required Bid Form and must be accompanied by a Bid Bond on State Buildings Programs Bid Bond Form Sc-6.14 in an amount not less than 5% of the total Bid. The Bid Bond may also be (1) a cashier’s check or (2) a certified check made payable to the Treasurer of the State of Colorado in an amount not less than 5% of the total Bid. The Bid Bond is submitted as a guaranty that the Bid will be maintained in full force and effect for a period of thirty (30) days after the opening of the Bids for the project.

5. The Bidder promises, in submitting his Bid, that if issued a Notice of Award, he will, within the prescribed time, execute the required Agreement, furnish the required Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance, or forfeit his Bid Guaranty as Liquidated Damages.

6. Preference shall be given to Colorado resident bidders and for Colorado labor, as provided by law.
7. Contractor's Registration Requirement deleted as of 11/2/09.

Pre-Bid Meeting

A mandatory Pre-Bid Meeting will be held at 10:00 AM 06/16/11 at CU Research Park, Sybase Building, 3665 Discovery Drive, Boulder, CO.

Sealed Bids will be received from qualified contractors until this date and time at this location:

Date & Time: 06/30/11 2:00 PM – Room 321, Research Laboratory No. 2, 1540 30th Street, Boulder, CO.

Address: Department of Facilities Management
Research Laboratory No. 2
1540 30th Street, Third Floor
Boulder, CO 80309-0453

Point of Contact

Name: Lonnie Greim, Project Coordinator
Agency: University of Colorado at Boulder
Phone: 303-303-440-0212
Fax: 303-303-492-4082
Email: lonnie.greim@colorado.edu

This Notice is also available on the web at www.colorado.gov/dpa/dfp/sbrep

Media of Publication(s): The Daily Journal
Publication Dates: 06/07/11
1. **BID FORM**: Bidders are required to use the Bid form attached to the bidding documents. Each bidder is required to bid on all alternates and indicate the time from the date of the Notice to Proceed to Substantial Completion in calendar days, and in addition, the bidder is required to indicate the period of time to finally complete the project from Substantial Completion to Final Acceptance, also in calendar days. Bids indicating times for Substantial Completion and Final Acceptance in excess of the number of days indicated in the Advertisement for Bids for completion of the entire Project may be found non-responsive and may be rejected. The bid shall not be modified or conditioned in any manner. Bids shall be submitted in sealed envelopes bearing the address and information shown below. If a bid is submitted by mail, this aforementioned sealed envelope should be enclosed in an outer envelope and sent to the following addressee:

Facilities Management: Planning, Design & Construction  
Research Laboratory No. 2  
1540 30th Street, 3rd Floor Reception Desk  
Boulder, CO 80309

The outside of the sealed inner envelope should bear the following information:

Project # CP121908  
Project Name CU - LASP: Tenant Finish  
Name and Address of Bidder ________________________________  
Date of Opening 06/30/11  
Time of Opening 2:00 PM

A bid with missing or inconsistent information may be considered non-responsive and may not be evaluated. The University will be the sole judge in determining the acceptability of an offer. **The University also reserves the right to reject any or all bids in part or in whole and to waive technicalities.** Any decision shall be considered final.

2. **INCONSISTENCIES AND OMISSIONS**: Bidders may request clarification of any seeming inconsistencies, or matters seeming to require explanation, in the bidding documents at least three (3) business days prior to the time set for the opening of Bids. Decisions of major importance on such matters will be issued in the form of addendum.

3. **APPLICABLE LAWS AND REGULATIONS**: The bidder's attention is called to the fact that all work under this Contract shall comply with the provisions of all state and local laws, approved state building codes, ordinances and regulations which might in any manner affect the work to be done or those to be employed in or about the work. Attention is also called to the fact that the use of labor for work shall be governed by the provisions of Colorado law which are hereinafter set forth in Articles 27 and 52E of the GENERAL CONDITIONS.

4. **UNAUTHORIZED IMMIGRANTS**: Note that the Special Provisions of the General Conditions of the Contract includes the following language: **PUBLIC CONTRACTS FOR SERVICES - CRS 8-17.5-101 and PUBLIC CONTRACTS WITH NATURAL PERSONS - 24-76.5-101.** The Contractor certifies that the Contractor shall comply with the provisions of CRS 8-17.5-101 et seq. The Contractor shall not knowingly employ or contract with an illegal alien to perform work under this contract or enter into a contract with a subcontractor that fails...
to certify to the Contractor that the subcontractor shall not knowingly employ or contract with an illegal alien to perform work under this contract. The Contractor represents, warrants, and agrees that it (i) has verified that it does not employ any illegal aliens, through participation in the Basic Pilot Employment Verification Program administered by the Social Security Administration and Department of Homeland Security, and (ii) otherwise will comply with the requirements of CRS 8-17.5-102(2)(b). The Contractor shall comply with all reasonable requests made in the course of an investigation under CRS 8-17.5-102 by the Colorado Department of Labor and Employment. If the Contractor fails to comply with any requirement of this provision or CRS 8-17.5-101 et seq., the State may terminate this contract for breach and the Contractor shall be liable for actual and consequential damages to the State.

A Contractor that operates as a sole proprietor hereby swears or affirms under penalty of perjury that the Contractor (i) is a citizen of the United States or otherwise lawfully present in the United States pursuant to federal law, (ii) shall comply with the provisions of CRS 24-76.5-101 et seq, and (iii) shall produce one of the forms of identification required by CRS 24-76.5-103 prior to the effective date of this Contract. Except where exempted by federal law and except as provided in CRS 24-76.5-103(3), a Contractor that receives federal or state funds under this contract must confirm that any individual natural person eighteen years of age or older is lawfully present in the United States pursuant to CRS 24-76.5-103(4) if such individual applies for public benefits provided under this contract.

5. **TAXES:** The bidder’s attention is called to the fact that the Bid submitted shall exclude all applicable federal excise or manufacturers’ taxes and all state sales and use taxes as hereinafter set forth in Article 9C of the GENERAL CONDITIONS.

6. **OR EQUAL:** The words “OR EQUAL” are applicable to all specifications and drawings relating to materials or equipment specified. Any material or equipment that will fully perform the duties specified, will be considered “equal”, provided the bid submits proof that such material or equipment is of equivalent substance and function and is approved, in writing. Requests for the approval of “or equal” shall be made in writing at least five (5) business days prior to bid opening. During the bidding period, all approvals shall be issued by the Architect/Engineer in the form of addenda at least two (2) business days prior to the bid opening date.

7. **ADDENDA:** Owner/architect initiated addenda shall not be issued later than two (2) business days prior to bid opening date. All addenda shall become part of the Contract Documents and receipt must be acknowledged on the Bid form.

8. **METHOD OF AWARD - LOWEST RESPONSIBLE BIDDER:** If the bidding documents for this project require alternate prices, additive and/or deductible alternates shall be listed on the alternates bid form provided by the Principal Representative. Bidders should note the Method of Award is applicable to this Bid as stated below.

A. **DEDUCTIBLE ALTERNATES:** The lowest responsible Bid, taking into account the Colorado resident bidder preference provision of Colorado law, will be determined by and the contract will be awarded on the base bid combined with deductible alternates, deducted in numerical order in which they are listed in the alternates bid form provided by the Principal Representative. The subtraction of alternates shall result in a sum total within available funds. If this bid exceeds such amount, the right is reserved to reject all bids. An equal number of alternates shall be subtracted from the base bid of each bidder within funds available for purposes of determining the lowest responsible bidder.

B. **ADDITIVE ALTERNATES:** The lowest responsible Bid, taking into account the Colorado resident bidder preference provision of Colorado law, will be determined by and the contract will be awarded on the base bid plus all additive alternates added in the numerical order in which they are listed in the alternates bid form provided by the Principal Representative. The addition of alternates shall result in a sum total within available funds. If this bid exceeds such amount, the right is reserved to reject all bids. An equal number of alternates shall be added to the base bid of each bidder within funds available for purposes of determining the lowest responsible bidder.

C. **DEDUCTIBLE AND ADDITIVE ALTERNATES:** Additive alternates will not be used if deductible alternates are used and deductable alternates will not be used if additive alternates are used.
9. **NOTICE OF CONTRACTOR’S SETTLEMENT** – Agencies/institutions must indicate in the initial Solicitation (Advertisement for Bids, Documented Quotes, or Requests for Proposals) whether settlement will be advertised in newspapers or electronic media. The Advertisement for Bids can be located at the web site: www.colorado.gov/dpa/dfp/sbrep/constructdesign.htm (Click on the link below the second paragraph Colorado Construction and Design Notices)

10. **CONTRACTOR QUALIFICATIONS:**

A. **Prime Contractors:**
   a. Prime Contractors bidding this project must complete “University of Colorado (UCB) Contractor Statement of Experience,” and submit it with their Bid.

   b. The Prime Contractor must meet the following minimum requirements and provide written information substantiating their qualifications for evaluation. A Bidder may be found to be non-responsive and their bid rejected if the minimum requirements are not met.

   (1) The Prime Contractor must have successfully completed three (3) projects of $750,000.00 (or larger) in the last five (5) years which were similar in complexity and type to this project. For each project list:
   - Project Title, Description contact amount, principle owner contact, Name and location of project, along with a brief description of the project (include size & function).
   - Name, address and phone number of client/ owner and their representative.
   - Contract value and type of contract (prime or subcontract).
   - Year in which work was completed.

   (2) The Contractor must have successfully completed an aggregate of $2,250,000.00 of projects in the last five (5) years which were similar in complexity and type on which he acted as the prime contractor (may be the same projects listed in item (1), if applicable).

   (3) The firm must have been in business as a Contractor for the last five (5) years.

B. **Subcontractors**
   a. The Prime Contractor is required to provide subcontractors which meet minimum qualifications for the trades listed below.

   The right is reserved to reject subcontractors that do not meet the minimum requirements. The Prime Contractor will be required to replace rejected subcontractor(s) with one(s) that meet the minimum requirements with no increase in the Bid Amount prior to the Award of Contract.

   Prime Contractor and Subcontractor(s) are advised that there are conditions within the Contract Documents requiring special knowledge and experience to properly execute. The University will require verification of experience to adequately provide materials and perform labor required for the following:
   - General Contracting
   - Mechanical Contracting
   - Electrical Contracting
   - Structured Cable / Technology Contracting
     Must have been in the Communications business for 5 yrs.
   - Fire Sprinkler Contracting

   b. For the trades listed (subcontractors) above, the apparent low bidder must submit, within 72 hours of receipt of bids except for holidays and weekends, the “University of Colorado Contractor’s Statement of Experience.”
c. In addition to the information requested in Item (1), the Subcontractor must meet the following minimum requirements and provide written information substantiating their qualifications for evaluation. A Bidder may be found to be non-responsive and their bid rejected if the minimum requirements are not met:

(1) The firm must have been in business for the last five (5) years as trade proposed for this work.

(2) The firm must have successfully completed at least two (2) projects of similar size, type, and complexity in the last five (5) years. The information must include the following:
   (a) Building type description (function use)
   (b) Building gross square footage
   (c) Subcontract description (be specific)
   (d) Subcontract amount
   (e) Subcontract change orders
   (f) Building owner representative and current telephone number
   (g) Building architect name and current telephone number
   (h) General contract name and current telephone number

(3) This firm shall give evidence of being able to be bonded up to the value of his work for this project. A letter shall be provided by the bonding agency assuring capability of bonding this subcontract amount.

11. **SITE ACCESS:** Contractors / Bidders may schedule a time subsequent to the Site Inspection / Pre-bid Conference to take measurements or further observe existing conditions by contacting:

   Name: Lonnie Greim  
   Agency: University of Colorado at Boulder  
   Phone: 303-440-0212  
   Fax: 303-492-4082  
   Email: lonnie.greim@colorado.edu

12. **BID SCHEDULE:**

   Publication date: 06/07/11  
   Plans specification available: 06/16/11 10:00 AM  
   Mandatory pre-bid conference: 06/16/11 10:00 AM  
   Last day for questions: 06/22/11 2:00 PM  
   Last day for addenda issue: 06/27/11 2:00 PM  
   Bid date: 06/30/11 2:00 PM

13. ALL questions should be emailed to Peter Carlson: Peter.Carlson@burkettdesign.com and Ted.Maestas@burkettdesign.com and copied to Lonnie.Greim@colorado.edu

END
City of Boulder
Sales/Use Tax Division
303-441-3050

CONTRACTORS WORKING ON NON-CITY PERMITTED PROJECTS

To all Contractors working within the City of Boulder:

Under Boulder’s Revised Code, the contractor is deemed to be the consumer of materials used in the construction project. Contractors may not avoid payment of the City of Boulder sales or use tax by placing provisions in a construction agreement or by using the name of a tax-exempt entity on an invoice or purchase order, regardless that the contractor is indicated thereon as the agent of a tax-exempt entity. No exemption certificate issued by the Colorado Department of Revenue or any other taxing authority shall be recognized as a basis for exemption from sales or use taxes.

Estimated use tax must be remitted to the City of Boulder prior to the start of the project. The tax is computed on the full contract price of the project. Follow these steps to compute and remit the sales/use tax to the City:

1. Multiply the full contract price by 0.5 and then multiply the resulting product by the tax rate of 3.41% (0.0341). This is the tax that is due to the City prior to the start of the project.
2. Remit the tax to the Sales Tax Department at 1777 Broadway, P.O. Box 791, Boulder, CO 80306-0791 along with a copy of this completed form.
3. At the completion of the project the construction company has two options for closing out the project with the city.
   - Use the formula in (1.) above to compute the final tax due based on the final contract price (including all change orders). Remit the additional tax due or file a request for refund with the City; or
   - Request that the city perform a full audit. Contact Ed Kaiser at 303-441-3921 or kaisere@bouldercolorado.gov to inform the City of which option you have chosen.

Contractor Name: ________________________________
Address: _______________________________________
Phone #: ___________________ Contact Person: __________
Project Name: ________________________________
Project Address: ______________________________

Full Contract price
Multiply ‘A’ by 0.5
Multiply ‘B’ by 0.0341

A. ___________________________
B. ___________________________
C. ___________________________

"C" is the amount of tax due to the City of Boulder. If you have any questions regarding sales/use tax or this process, contact Ed Kaiser at the above phone number or address.

Date received: ______________________ City Authority Signature: ______________________

1777 BROADWAY P.O. BOX 791 BOULDER, CO 80306 303/441-3921
University of Colorado at Boulder

CONTRACTOR’S
STATEMENT OF EXPERIENCE

CU – LASP: Tenant Finish
Project No. CP121908

Project Manager: Lonnie Greim
Phone: 303-440-0212
Email: lonnie.greim@colorado.edu

Architect/Engineer: Peter Carlson – BurkettDesign

Contacts: Ted.Maestas@burkettdesign.com
Peter.carso@burkettdesign.com

June 2011

This is a project specific qualification form. Contractor must fill this out on each project.
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UNIVERSITY OF COLORADO AT BOULDER
CONTRACTOR’S QUALIFICATION STATEMENT

INFORMATION FORM

STATEMENT OF ____________________________________________

(Contractor)

ADDRESS ____________________________________________

(Street or PO Box) (City) (State) (Zip)

TELEPHONE/FAX NO. ___________________________ ___________________________

(telephone) (fax)

DATE OF EXPERIENCE STATEMENT __________________________

PRINCIPLE OWNER/OFFICER ___________________________

(Names(s) and Official Title(s))

Please indicate below if your company qualifies as one of the following:

<table>
<thead>
<tr>
<th>Minority Business Enterprise (MBE)</th>
<th>YES __</th>
<th>NO __</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Woman-Owned Business Enterprise (WBE)</th>
<th>YES __</th>
<th>NO __</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justification:</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Small Business Enterprise (SBE)</th>
<th>YES __</th>
<th>NO __</th>
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<tbody>
<tr>
<td>Justification:</td>
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<td></td>
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</table>

<table>
<thead>
<tr>
<th>Disadvantaged Business Enterprise (DBE)</th>
<th>YES __</th>
<th>NO __</th>
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</thead>
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<tr>
<td>Justification:</td>
<td></td>
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</tbody>
</table>
UNIVERSITY OF COLORADO AT BOULDER
CONTRACTOR’S QUALIFICATION STATEMENT

TYPES OF WORK

(1) If you are a General Contractor interested in bidding on all types of construction, mark “All Classes of Construction” only.
(2) If you are interested in contracting directly with the University for certain types of work only, mark in the column provided after the particular types of work on which you wish to bid.

<table>
<thead>
<tr>
<th>TYPES OF WORK</th>
<th>MARK WITH (X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All Classes of Construction</td>
<td></td>
</tr>
<tr>
<td>2. <strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>3. Mechanical</td>
<td></td>
</tr>
<tr>
<td>4. Electrical</td>
<td></td>
</tr>
<tr>
<td>5. Excavating and Grading</td>
<td></td>
</tr>
<tr>
<td>6. Concrete</td>
<td></td>
</tr>
<tr>
<td>7. Structural Steel</td>
<td></td>
</tr>
<tr>
<td>8. Steel and Miscellaneous Iron</td>
<td></td>
</tr>
<tr>
<td>9. Painting and Decorating</td>
<td></td>
</tr>
<tr>
<td>10. Laboratory Equipment</td>
<td></td>
</tr>
<tr>
<td>11. Elevator Installation</td>
<td></td>
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<tr>
<td>12. Plumbing</td>
<td></td>
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<tr>
<td>13. Heating and Ventilating</td>
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<tr>
<td>14. Air Conditioning</td>
<td></td>
</tr>
<tr>
<td>15. Boiler and Equipment</td>
<td></td>
</tr>
<tr>
<td>16. Environmental (Describe)</td>
<td></td>
</tr>
<tr>
<td>17. Other (Describe)</td>
<td></td>
</tr>
<tr>
<td>18. Other (Describe)</td>
<td></td>
</tr>
<tr>
<td>19. Other (Describe)</td>
<td></td>
</tr>
<tr>
<td>20. Other (Describe)</td>
<td></td>
</tr>
</tbody>
</table>
IDENTIFICATION

(The signatory of this questionnaire guarantees the truth and accuracy of all statements and of all answers to questions hereinafter made.)

LEGAL NAME ________________________________

PRINCIPAL OFFICE

(Street or PO Box) (City) (State) (Zip)

A Corporation A Copartnership An Individual Combination

GENERAL INFORMATION

A. Are you licensed as a contractor? Yes ( ) No ( )

Licensed in Location License No.
the name of (City or State) & Type


B. How many years has your organization been in business as a contractor under your present business name? __________________________

C. How many years experience in __________________________ construction work has your organization had? (Type)

(a) As a prime contractor? (b) As a subcontractor?

D. Have you or your organization, or any officer or partner thereof, failed to complete a contract? ______________

If so, give details ________________________________________________________________


E. If you have a controlling interest in any firms presently qualified with the University, show names thereof:

________________________________________________________


F. We normally perform ________% of the work with our own forces.

List trades: ____________________________________________________________

Where qualification is based on a combination of several organizations, show the experience and equipment of the combined organizations.
G. Has your firm been involved in any litigation in the past five (5) years? Yes ( ) No ( )
If yes, explain (listing type, kind, plaintiff, defendant, etc. and state the current status).

H. Are there any activities or interests of officers, principle stockholders, or employees of your firm or other factors which would place your firm and the University of Colorado at Boulder in a position of “Conflict of Interests”?

Yes ( ) No ( ) If yes, or in doubt, explain.

I. Has your firm ever been involved in any bankruptcy action as a bankrupt?

Yes ( ) No ( ) If yes, explain.
UNIVERSITY OF COLORADO AT BOULDER
CONTRACTOR’S QUALIFICATION STATEMENT

PERSONNEL OF ORGANIZATION

1. Name the persons with whom you have been associated in business as partners or business associates in each of the last five (5) years.

2. Show the construction experience of the principal individuals of your present organization in the following tabulation:

<table>
<thead>
<tr>
<th>Individual's Name</th>
<th>Present Position or Office in Your Organization</th>
<th>Years of Construction Experience</th>
<th>Magnitudes and Type of Work</th>
<th>In What Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROJECT EXPERIENCE

Show the projects your organization has completed during the last five years in the following tabulation:

<table>
<thead>
<tr>
<th>Year Completed</th>
<th>Project</th>
<th>Type of Work (See Page 2)</th>
<th>Location</th>
<th>Contract Value</th>
<th>Contracting Authority</th>
<th>In what Capacity</th>
</tr>
</thead>
</table>
WORK CURRENTLY UNDER CONTRACT

<table>
<thead>
<tr>
<th>Expected Completion Date</th>
<th>Project</th>
<th>Type of Work (See Page 1)</th>
<th>Location</th>
<th>Contract Value</th>
<th>Contracting Authority</th>
<th>Architect or Engineer</th>
</tr>
</thead>
</table>
SURETIES

List the Surety Companies that have bonded your work for the past five (5) years:

<table>
<thead>
<tr>
<th>Name of Surety and Name and Address of Agent</th>
<th>Project and Location</th>
<th>Period of Bond From</th>
<th>Period of Bond To</th>
<th>General Comments</th>
</tr>
</thead>
</table>


CORPORATION / CO-PARTNERSHIP

CORPORATION:
(If a corporation, answer this:)

When Incorporated

In What State

President’s Name

Vice President’s Name

Secretary’s Name

Treasurer’s Name

CO-PARTNERSHIP:
(If a co-partnership, answer this:)

Date of Organization

State whether partnership is general, limited, or association

Name and address of each partner:

(name) (name)

(address) (address)

WHERE QUALIFICATION IS BASED ON A COMBINATION OF ORGANIZATIONS, THE APPROPRIATE (ATTACHED) AFFIDAVITS MUST BE EXECUTED FOR EACH MEMBER OF SUCH COMBINATION.
UNIVERSITY OF COLORADO AT BOULDER
CONTRACTOR’S QUALIFICATION STATEMENT

AFFIDAVIT FOR CORPORATION

__________________________________________ certifies and says: That he is
(Name of officer)

__________________________________________ of the ___________________________________________
(Official capacity)

corporation submitting this statement of experience: that he/she has read the same, and
that the same is true of his/her own knowledge: that the statement is for the purpose of
inducing the University of Colorado to supply the submittor with plans and specifications,
and that any vendor, or other agency therein named is hereby authorized to supply the
University of Colorado with any information necessary to verify the statement: and that
furthermore, should this statement at any time cease to properly and truly represent
his/her condition in any substantial respect, it will refrain from further bidding on
University work until it shall have submitted a revised and corrected statement.

I certify and declare under penalty of perjury that the foregoing is true and correct:

Subscribed on __________ at __________, __________, State of __________
(date) (city) (county)

NOTE: Use full corporate name and
attach corporate seal here. __________________________________________
(Officer must sign here)

NOTE: Statement will be returned unless affidavit is completed in EVERY respect.
AFFIDAVIT FOR CO-PARTNERSHIP

______________________________ certifies and says: That he/she is a partner of
(Name of partner)

the partnership of ____________________________ : That said partnership
(Name of Firm)

submitted this statement of experience: that he/she has read the same, and that the
same is true of his/her own knowledge: that the statement is for the purpose of inducing
the University of Colorado to supply the submittor with plans and specifications, and that
any vendor, or other agency therein named is hereby authorized to supply the University
of Colorado with any information necessary to verify the statement: and that
furthermore, should this statement at any time cease to properly and truly represent the
condition of said firm in any substantial respect, it will refrain from further bidding on
University work until they shall have submitted a revised and corrected statement.

I certify and declare under penalty of perjury that the foregoing is true and correct:

Subscribed on ___________ at __________, __________, State of ________________
(date) (city) (county)

The foregoing statement and affidavit are hereby offered.

______________________________  (Member of Firm must sign here)

______________________________  (Title)

______________________________  (Name of Firm)

(Remaining members of Firm sign here)

NOTE: Statement will be returned unless affidavit is completed in EVERY respect.
UNIVERSITY OF COLORADO AT BOULDER
CONTRACTOR’S QUALIFICATION STATEMENT

AFFIDAVIT FOR INDIVIDUAL doing business

(Name of individual) (Name of Firm)
certifies and says: That he/she is the person submitting this statement of experience: that he/she has read the same, and that the same is true of his/her own knowledge: that the statement is for the purpose of inducing the University of Colorado to supply the submittor with plans and specifications, and that any vendor, or other agency therein named is hereby authorized to supply the University of Colorado with any information necessary to verify the statement: and that furthermore, should this statement at any time cease to properly and truly represent his/her condition in any substantial respect, it will refrain from further bidding on University work until it shall have submitted a revised and corrected statement.

I certify and declare under penalty of perjury that the foregoing is true and correct:

Subscribed on __________ at _____________, ____________, State of ________________
(date) (city) (county)

NOTE: Statement will be returned unless affidavit is completed in EVERY respect. _____________________________
(Applicant must sign here)
UNIVERSITY OF COLORADO AT BOULDER
CONTRACTOR’S QUALIFICATION STATEMENT

BIDDING INFORMATION

QUALIFICATION

The University of Colorado will qualify or disqualify a Contractor on the basis of:

(1) The information contained in this statement and
(2) Past contract experience with the University.

NOTIFICATION

The University of Colorado will, in writing, notify Contractors of their qualification or disqualification.

END
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

BID

Institution/Agency: University of Colorado at Boulder
Project No./Name: CP121908 – CU – LASP: Tenant Finish

Bidder Acknowledges Receipt of Addenda Numbers:

Base Bid
(Refer to Bid Alternate Form SC-6.13.1 Attached, If Applicable)

Bidder’s Time of Completion
a. Time Period from Notice to Proceed to Substantial Completion: 62 Calendar days
b. Time Period from Substantial Completion to Final Acceptance: 21 Calendar days
c. Total Time of Completion of Entire Project (a + b): 85 Calendar days

1. BID: Pursuant to the advertisement by the State of Colorado dated June 7, 2011 undersigned bidder hereby proposes to furnish all the labor and materials and to perform all the work required for the complete and prompt execution of everything described or shown in or reasonably implied from the Bidding Documents, including the Drawings and Specifications, for the work and for the base bid indicated above. Bidders should include all taxes that are applicable.

2. EXAMINATION OF DOCUMENTS AND SITE: The bidder has carefully examined the Bidding Documents, including the Drawings and Specifications, and has examined the site of the Work, so as to make certain of the conditions at the site and to gain a clear understanding of the work to be done.

3. PARTIES INTERESTED IN BID: The bidder hereby certifies that the only persons or parties interested in this Bid are those named herein, and that no other bidder or prospective bidder has given any information concerning this Bid.

4. BID GUARANTEE: This Bid is accompanied by the required Bid Guarantee. You are authorized to hold said Bid Guarantee for a period of not more than thirty (30) days after the opening of the Bids for the work above indicated, unless the undersigned bidder is awarded the Contract, within said period, in which event the Director, State Buildings Programs, may retain said Bid Guarantee, until the undersigned bidder has executed the required Agreement and furnished the required Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance and Affidavit Regarding Unauthorized Immigrants.

5. TIME OF COMPLETION: The bidder agrees to achieve Substantial Completion of the Project from the date of the Notice to Proceed within the number of calendar days entered above, and in addition, further agrees that the period between Substantial Completion and Final Acceptance of the Project will not exceed the number of calendar days noted above. If awarded the Work, the bidder agrees to begin performance within ten (10) days from the date of the Notice to Proceed subject to Article 46, Time of Completion and Liquidated Damages of The General Conditions of the Contract, and agrees to prosecute the Work with due diligence to completion. The bidder represents that Article 54D has been reviewed to determine the type and amount of any liquidated damages that may be specified for this contract.

6. EXECUTION OF DOCUMENTS: The bidder understands that if this Bid is accepted, bidder must execute the required Agreement and furnish the required Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance and Affidavit Regarding Unauthorized Immigrants within ten (10) days from the date of the Notice of Award, and that the bidder will be required to sign to acknowledge and accept the Contract Documents, including the Drawings and Specifications.

7. ALTERNATES: Refer to the Information for Bidders (SC-6.12) for Method of Award for Alternates and use State Form SBP-6.13.1 Bid Alternates form to be submitted with this bid form if alternates are requested by the institution/agency in the solicitation documents.

8. Submit wage rates (direct labor costs) for prime contractor and subcontractor as requested by the institution/agency in the solicitation documents.

9. The right is reserved to waive informalities and to reject any and all Bids.

Dated this __________ Day of ________________________ , 2011

THE BIDDER:

/ Company Name

/ Email Address

/ Address (including city, state and zip)

/ Phone

Signature

Name (Print) and Title

SIGNATURES: If the Bid is being submitted by a Corporation, the Bid should be signed by an officer, i.e., President or Vice-President. If a sole proprietorship or a partnership is submitting the Bid, the Bid shall so indicate and be properly signed.
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

BID ALTERNATES FORM

Institution/Agency: University of Colorado at Boulder
Project No./Name: CP 121908 / CU – LASP – Tenant Finish

Additive alternates will not be used if deductible alternates are used and deductible alternates will not be used if additive alternates are used.

Deductive Alternates (If Applicable)

Refer to specification section 01050 for descriptions of add alternates. If the add alternates are accepted, the base bid would be modified by the amount entered by the bidder.

Add Alternate No. 1 Description:
Demo/remove existing interior partitions at Floor 1 as indicated.
Provide all new construction including new walls as shown on A2.01. Include all activities related to new finishes as indicated in the Base Bid.

$ ______________________________

Add Alternate No. 2 Description:
Refer to sheet A7.01, A8.01, M3.0 & E3.0
Demo/remove existing interior partitions at Floor 2 as indicated.
Demo/remove existing floor/wall finishes
Demo/remove existing suspended ceiling & lay-in acoustic ceiling tile.
Construct new restroom core as indicated.

$ ______________________________

Add Alternate No. 3 Description:
Provide alternate pricing for LED source in lieu of fluorescent lamps.
LED shall provide equal lumens and efficiency as the fluorescent fixture.

$ ______________________________

THE BIDDER:

Company Name

Signature Date
STATE OF COLORADO  
OFFICE OF THE STATE ARCHITECT  
STATE BUILDINGS PROGRAMS

BID BOND

Institution/Agency:  University of Colorado at Boulder  
Project No./Name:  CP121908 – CU – LASP: Tenant Finish

KNOW ALL MEN BY THESE PRESENTS:

WHEREAS, _______________________________, hereinafter called the “PRINCIPAL”, is submitting a PROPOSAL for the above described project, to the STATE OF COLORADO, hereinafter called the “OBLIGEE”.

WHEREAS, the Advertisement for Bids has required as a condition of receiving the Proposals that the Principal submit with the PROPOSAL GUARANTY in an amount not less than five per cent (5%) of the Proposal, which sum it is specifically agreed is to be forfeited as Liquidated Damages in the event that the Principal defaults in his obligation as hereinafter specified, and, in pursuance of which Requirement, this Bid is made, executed and delivered.

NOW THEREFORE, the Principal and _______________________________, a corporation of the State of _______________________________, duly authorized to transact business in Colorado, as Surety, are held and firmly bound unto the Obligee, in the sum of five per cent (5%) of the Principal’s total bid price, lawful money of the United States for the payment of which sum, well and truly to be made to the Obligee, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

FURTHER THAT, a condition of the obligation that the Principal shall maintain his Proposal in full force and effect for thirty (30) days after the opening of the proposals for the project, or, if the Principal’s Proposal is accepted, the Principal shall, within the prescribed time, execute the required Agreement, furnish the required Performance Bond, Labor and Material Payment Bond, Insurance Policy, and Certificates of Insurance, then this obligation shall be null and void, otherwise it shall remain in full force and effect, and subject to forfeiture upon demand as Liquidated Damages.

IN WITNESS WHEREOF said Principal and Surety have executed this Bond, this _____ day of ________, A.D., 2011.

(Corporate Seal)  

THE PRINCIPAL

Company Name

Address (including city, state and zip)  

Phone number:  

Signature

Name (Print) and Title

SIGNATURES  

If the “Principal” is doing business as a Corporation, the Bid Bond shall be signed by an officer, i.e., President or Vice President. The signature of the officer shall be attested to by the Secretary and properly sealed.

If the “Principal” is an individual or a partnership, the Bid Bond shall so indicate and be properly signed.

(Corporate Seal)  

THE SURETY

Secretary  

By  

Attorney-in-Fact

THIS BOND MUST BE ACCOMPANIED BY POWER OF ATTORNEY, EFFECTIVELY DATED. FAILURE TO PROVIDE A PROPERLY EXECUTED BID BOND WITH A PROPERLY EXECUTED POWER OF ATTORNEY WILL RESULT IN THE BIDDER’S PROPOSAL BEING DEEMED NON-RESPONSIVE.
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

NOTICE OF AWARD

Date of Notice: ____________________________

Date to be inserted by the Principal Representative

Institution/Agency: University of Colorado at Boulder

Project No./Name: CP121908 - CU - LASP: Tenant Finish

TO:

The State of Colorado, represented by the undersigned, has considered the Proposals submitted for the above described work.

Your Proposal, deemed to be in the best interest of the State of Colorado, in the amount of Thousand, and no/100 Dollars* ($ * ) is hereby accepted, pending final execution of the Agreement.

<table>
<thead>
<tr>
<th>Bid Type</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Bid</td>
<td>$</td>
</tr>
<tr>
<td>Bid Alternate No.1</td>
<td>$</td>
</tr>
<tr>
<td>Bid Alternate No.2</td>
<td>$</td>
</tr>
<tr>
<td>Bid Alternate No.3</td>
<td>$</td>
</tr>
<tr>
<td>Total Contract Amount</td>
<td>$</td>
</tr>
</tbody>
</table>

You are required to execute the approved Agreement and to furnish the Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance within ten (10) days from the date of this Notice.

If you fail to execute said Agreement and to furnish said Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance, and Certification and Affidavit Regarding Unauthorized Immigrants within ten (10) days from the date of this Notice, the State Controller is entitled to retain the amount of the Proposal Guaranty submitted with your Proposal as Liquidated Damages. In this event, the right is reserved to consider all of your rights arising out of the acceptance of your Proposal as abandoned and to award the work covered by your Proposal to another, or to re-advertise the Project, or otherwise dispose thereof.

By ____________________________________________
State Buildings Programs
(of Authorized Delegate)
Paul M. Leef, AIA, TM AP
Campus Architect &
Director, Planning, Design & Construction

By ____________________________________________
Principal Representative
(Institution or Agency)
Ronald L. Ried, Director
Facilities Management Business Services

When completely executed, this form is to be sent by certified mail to the Contractor by the Principal Representative or by any other means to which the parties agree.
CONTRACTOR'S AGREEMENT
DESIGN/BID/BUILD
(STATE FORM SC-6.21)

CONTRACT ID NUMBER:

AGENCY IDENTIFICATION NUMBER:

PROJECT NUMBER: CP121908

PROJECT NAME: CU – LASP: Tenant Finish

PROJECT MANAGER: Lonnie Greim

CONTRACTOR:

June 2011
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<tr>
<th>Section</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECITALS</td>
<td>1</td>
</tr>
<tr>
<td>ARTICLE 1. Performance of the Work</td>
<td>1</td>
</tr>
<tr>
<td>ARTICLE 2. Provisions of the Contract Documents</td>
<td>1</td>
</tr>
<tr>
<td>ARTICLE 3. Time of Completion</td>
<td>1</td>
</tr>
<tr>
<td>ARTICLE 4. Essential Condition</td>
<td>1</td>
</tr>
<tr>
<td>ARTICLE 5. Contract Sum</td>
<td>1</td>
</tr>
<tr>
<td>ARTICLE 6. Contract Documents</td>
<td>1</td>
</tr>
</tbody>
</table>

SIGNATURE APPROVALS

Attachment – Notice of Award

Exhibits:

- A Contractor's Bid (Form SC-6.13)
- B Performance Bond (Form SC-6.22)
- C Labor and Material Payment Bond (Form SC-6.221)
- D Insurance Certificates
- E Certification and Affidavit Regarding Unauthorized Immigrants (required at contract signing prior to commencing work)
- F Contract Management Information Construction Contractor
1. PARTIES. THIS AGREEMENT is entered into by and between the STATE OF COLORADO, acting by and through the Regents of the University of Colorado, a body corporate, hereinafter referred to as the Principal Representative, and having its offices at hereinafter referred to as the Contractor.

2. EFFECTIVE DATE AND NOTICE OF NONLIABILITY. This Agreement shall not be effective or enforceable until it is approved and signed by the State Controller or its designee (hereinafter called the “Effective Date”), but shall be effective and enforceable thereafter in accordance with its provisions. The State shall not be liable to pay or reimburse Contractor for any performance hereunder or be bound by any provision hereof prior to the Effective Date.

WHEREAS, the Principal Representative intends to replace west windows, south door & entry wall of the UMC building, hereinafter called the Project; and

WHEREAS, authority exists in Law and Funds have been budgeted, appropriated, and otherwise made available, and a sufficient unencumbered balance thereof remains available for payment in Fund Number / Account Number CP 121908, Contract Encumbrance Number TBD, and

WHEREAS, this is a phase one waived contract, waiver number 156 Contractors Agreement for Capital Construction Form SC6.21.

WITNESSETH, that the State of Colorado and the Contractor agree as follows:

ARTICLE 1. PERFORMANCE OF THE WORK
The Contractor shall perform all of the Work required for the complete and prompt execution of everything described or shown in, or reasonably implied from the Contract Documents for the above referenced Project.

ARTICLE 2. PROVISIONS OF THE CONTRACT DOCUMENTS
The Contractor agrees to perform the Work to the highest industry standards and to the satisfaction of the State of Colorado and its Architect/Engineer in strict accordance with the provisions of the Contract Documents.

ARTICLE 3. TIME OF COMPLETION
The Contractor agrees to Substantially Complete the Project within 62 calendar days from the date of the Notice to Proceed, in addition, the Contractor agrees to finally complete the Project from Substantial Completion to Final Acceptance within 21 calendar days for a total time of completion of the entire Project of 83 calendar days. The Contractor shall perform the Work with due diligence to completion.

ARTICLE 4. ESSSENTIAL CONDITION
Timely completion of the Project is an essential condition of this Agreement. The Contractor shall be subject to any liquidated damages described in Article 54D of The General Conditions of the Construction Contract SC-6.23 for failure to satisfactorily complete the Work within the time periods in Article 3 above.
ARTICLE 5. CONTRACT SUM
The Contractor shall be paid for the performance of this Agreement, subject to any additions and deductions as provided for in Articles 32, 34 and 35 of The General Conditions of the Construction Contract SC-6.23, the sum of Hundred and Thousand, Hundred and no/100 Dollars* ($ *).

<table>
<thead>
<tr>
<th>Base Bid</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Contract Amount</td>
<td>$</td>
</tr>
</tbody>
</table>

ARTICLE 6. CONTRACT DOCUMENTS
The Contract Documents, as enumerated in Article 1 of The General Conditions of the Construction Contract Sc-6.23, are all essential parts of this Agreement and are fully incorporated herein.

ARTICLE 7. SAFETY and SECURITY - Contractor understands that concern for the safety and well-being of University students and staff is of particular importance to the University. Contractor expressly acknowledges that it is Contractor's duty to take reasonable precautions to protect the University's students and staff. The extent of such precautions will depend on the particular circumstances of the work to be performed. However, to the extent that work to be performed involves security-sensitive functions or security-sensitive areas (e.g. unsupervised access to minors or work involving access to security-sensitive data), such precautions may include, but are not limited to, conducting criminal history checks on employees or agents assigned to such work at the University."
SIGNATURE APPROVALS:

THE PARTIES HERETO HAVE EXECUTED THIS CONTRACT

*Persons signing for Contractor hereby swear and affirm that they are authorized to act on Contractor’s behalf and acknowledge that the State is relying on their representations to that effect. Principal is not a recognized title and will not be accepted

Project Name/Number: CP 121908 / CU – LASP: Tenant Finish

THE CONTRACTOR

Legal Name of Contracting Entity

*Signature

By: Ronald. R. Ried, Director
   Facilities Management Business Services

Date: __________________________

STATE OF COLORADO

By: Paul M. Leef, AIA, LEED TM AP
   Campus Architect / Director, Planning, Design & Construction

Date: __________________________

ALL CONTRACTS MUST BE APPROVED BY THE STATE CONTROLLER:

CRS §24-30-202 requires the State Controller to approve all State Contracts. This Contract is not valid until signed and dated below by the State Controller or delegate. Contractor is not authorized to begin performance until such time. If Contractor begins performing prior thereto, the State of Colorado is not obligated to pay Contractor for such performance or for any goods and/or services provided hereunder.

APPROVED:

STATE OF COLORADO
Department of Law / Attorney General (or authorized Delegate)

By: __________________________
Date: __________________________
STATE OF COLORADO
CONTRACTOR’S AGREEMENT DESIGN/BID/BUILD
(STATE FORM SC-6.21)

EXHIBIT A – CP121908 – CU – LASP: Tenant Finish

CONTRACTOR’S BID (Form SBP-6.13)
STATE OF COLORADO
CONTRACTOR'S AGREEMENT DESIGN/BID/BUILD
(STATE FORM SC-6.21)

EXHIBIT B – CP121908 – CU – LASP: Tenant Finish

PERFORMANCE BOND (Form SC-6.22)
STATE OF COLORADO
CONTRACTOR'S AGREEMENT DESIGN/BID/BUILD
(STATE FORM SC-6.21)

EXHIBIT C – CP121908 – CU – LASP: Tenant Finish

LABOR AND MATERIAL PAYMENT BOND (Form SC-6.221)
STATE OF COLORADO
CONTRACTOR'S AGREEMENT DESIGN/BID/BUILD
(STATE FORM SC-6.21)

EXHIBIT D – CP121908 – CU – LASP: Tenant Finish

INSURANCE CERTIFICATE(S) (attached)
Certification and Affidavit Regarding Unauthorized Immigrants (required at contract signing prior to commencing work) (UI-1, attached)
KNOW ALL PERSONS BY THESE PRESENTS:

That the Contractor

as Principal and hereinafter called “Principal,”

and

as Surety and hereinafter called “Surety,” a corporation organized and existing under the laws of ___________ are held and firmly bound unto the STATE OF COLORADO acting by and through the Regents of the University of Colorado, a body corporate, hereinafter called the “Principal Representative”, in the sum of ___________ Dollars ($___________)

for the payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly, by these presents.

WHEREAS, the Principal and the State of Colorado acting by and through the Principal Representative have entered into a certain Contract, hereinafter called “Contract,” dated __________________________, 2011, for the construction of a PROJECT described as CU – LASP: Tenant Finish

which Contract is hereby by reference made a part hereof;
NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION, is such that, if the Principal shall promptly, fully and faithfully perform all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term of said Contract any extensions thereof that may be granted by the Principal Representative with or without notice to the Surety, and during the life of any guaranty required under the Contract, and shall also well and truly perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

AND THE SAID SURETY, for value received hereby stipulates and agrees that whenever the Principal shall be, and declared by the Principal Representative to be in default under said Contract, the State of Colorado having performed its obligations thereunder, the Surety may promptly remedy the default or shall promptly (1) Complete the Contract in accordance with its terms and conditions, or (2) Obtain a bid or bids for submittal to the Principal Representative for completing the Contract in accordance with its terms and conditions, and upon determination by the Principal Representative and Surety of the lowest responsible bidder, arrange for a contract between such bidder and the State of Colorado acting by and through the Principal Representative and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion, less the balance of the contract price but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount hereinbefore set forth. The term “balance of the contract price” as herein used shall mean the total amount payable to the Principal under the Contract and any amendments thereto, less the amount properly paid by the State of Colorado to the Contractor.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the State of Colorado.

IN WITNESS WHEREOF said Principal and Surety have executed this Bond, this ______ day of __________________, A.D. 2011.

(Corporate Seal) THE PRINCIPAL

ATTEST:

By: ________________________________
Title: ________________________________

Secretary

(Corporate Seal) SURETY

By: ________________________________
Attorney-in-fact

THIS BOND MUST BE ACCOMPANIED BY POWER OF ATTORNEY, EFFECTIVELY DATED

Note: This bond is issued simultaneously with another bond conditioned for the full and faithful payment for all labor and material of the contract.
Know All Persons by These Presents:

That the Contractor

as Principal and hereinafter called "Principal,"

and

as Surety and hereinafter called "Surety," a corporation organized and existing under the laws of ______________________ are held and firmly bound unto the STATE OF COLORADO acting by and through the Regents of the University of Colorado at Boulder, a body corporate,

hereinafter called "Principal Representative," and to all subcontractors and any others who have supplied or furnished or shall supply or furnish materials, rental machinery, tools, or equipment actually used in the performance of or in connection with said Contract, hereinafter called "Obligees" in the sum of ____________ Dollars ($______________)

together with interest at the rate of eight per cent (8%) per annum on all payments becoming due in accordance with said Contract, from the time such payments shall become due until such payment shall be made, for the payment of which, well and truly made to the Obligees, the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly, by these presents.

Whereas, the Principal and the State of Colorado acting by and through the Principal Representative have entered into a certain Contract, hereinafter called "Contract," dated ________________________ 2011 for the construction of a PROJECT described as CU – LASP: Tenant Finish

which Contract is hereby by reference made a part hereof;
NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal and the Surety shall fully indemnify and save harmless the State of Colorado and the Principal Representative from and against any and all costs and damages, including patent infringements, which either may suffer by reason of any failure or failures of the Principal promptly and faithfully to perform all terms and conditions of said Contract and shall fully reimburse and repay the State of Colorado and the Principal Representative all outlay and expense which the State of Colorado and the Principal Representative may incur in making good any such failure or failures, and further, if the Principal and his subcontractors shall duly and promptly pay for any and all labor, materials, team hire, sustenance, provisions, provender, rental machinery, tools, or equipment and other supplies which have been or shall be used or consumed by said Principal or his subcontractors in the performance of the work of said Contract, and it said Principal shall duly and promptly pay all his subcontractors the sums due them for any and all materials, rental machinery, tools, or equipment and labor that have been or shall be furnished, supplied, performed or used in connection with performance of said Contract, and shall also fully indemnify and save harmless the State of Colorado and the Principal Representative to the extent of any and all expenditures which either or both of them may be required to make by reason of any failures or defaults by the Principal or any subcontractor in connection with such payments; then this obligation shall be null and void, otherwise it shall remain in full force and effect.

It is expressly understood and agreed that any alterations which may be made in the terms of said Contract or in the work to be done under said Contract, or any extension(s) of time for the performance of the Contract, or any forebearance on the part of either the State of Colorado or the Principal to any of the others, shall not in any way release the Principal and the Surety, or either of them, their heirs, executors, administrators, successors or assigns from their liability hereunder, notice to the Surety of any such alteration, extension or forbearance being hereby waived.

IN WITNESS WHEREOF, the Principal and the Surety have executed this Bond, this __________ day of ______, A.D., 2011.

(Corporate Seal)

THE PRINCIPAL

ATTEST:

By: ______________________________
Title: _____________________________

Secretary

(Corporate Seal)

SURETY

By: ______________________________
Attorney-in-fact

THIS BOND MUST BE ACCOMPANIED BY POWER OF ATTORNEY, EFFECTIVELY DATED

Note: This bond is issued simultaneously with another bond conditioned for the full and faithful performance of the contract.
THE GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT
DESIGN/BID/BUILD
(STATE FORM SC-6.23)

Project Name:  CU – LASP – Tenant Finish
Project No.  CP 121908
Project Manager:  Lonnie Greim
Date:  June 2011
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Note: The sections of the General Conditions indicated in *italics* (Articles 35 General and 35A, 35B, 37, 38, 46, 48B, 49 and 50) are regulatory and cannot be modified except through appropriate rule making procedures through the Division of Finance and Procurement, Department of Personnel & Administration.
ARTICLE 1. DEFINITIONS

A. CONTRACT DOCUMENTS
The Contract Documents consist of the following some of which are procedural documents used in the administration and performance of the Agreement:

1. Agreement; (SC-6.21);
2. Performance Bond (SC-6.22) and Labor and Material Payment Bond (SC-6.221);
3. General Conditions of the Construction Contract (SC-6.23) and if applicable, Supplementary General Conditions;
4. Detailed Specification Requirements, including all addenda issued prior to the opening of the bids; and,
5. Drawings, including all addenda issued prior to the opening of the bids.
6. Change Orders (SC-6.31) and Amendments (SC-6.0), if any, when properly executed.
7. Authorization to Bid (SBP-6.10)
8. Information for Bidders (SBP-6.12);
9. Bid (SBP-6.13);
10. Bid Bond (SBP-6.14);
11. Notice of Award (SBP-6.15);
12. Builder's risk insurance certificates of insurance (ACORD 25-S);
13. Liability and workers' compensation certificates of insurance;
14. Notice to Proceed (Design/Bid/Build) (SBP-6.26);
15. Notice of Approval of Occupancy/Use (SBP-01);
16. Notice of Partial Substantial Completion (SBP-071);
17. Notice of Substantial Completion (SBP-07);
18. Notice of Partial Final Acceptance (SC-6.27);
19. Notice of Final Acceptance (SBP-6.271);
20. Notice of Partial Contractor's Settlement (SC-7.3);
21. Notice of Contractor's Settlement (SBP-7.31);
22. Application and Certificate for Contractor's Payment (SBP-7.2);
23. Other procedural and reporting documents or forms referred to in the General Conditions, the Supplementary General Conditions, the Specifications or required by the State Buildings Programs or the Principal Representative, including but not necessarily limited to Pre-Acceptance Check List (SBP-05) and the Building Inspection Record (SBP-BIR). A list of the current standard State Buildings Programs forms applicable to this Contract may be obtained from the Principal Representative on request.

B. DEFINITIONS OF WORDS AND TERMS USED
1. AGREEMENT. The term "Agreement" shall mean the written agreement entered into by the State of Colorado acting by and through the Principal Representative and the Contractor for the
2. Performance of the Work and payment therefore, on State Form SC-6.21. The term Agreement when used without reference to State Form SC-6.21 may also refer to the entirety of the parties’ agreement to perform the Work described in the Contract Documents or reasonably inferable there from. The term “Contract” shall be interchangeable with this latter meaning of the term Agreement.

3. ARCHITECT/ENGINEER. The term “Architect/Engineer” shall mean either the architect of record or the engineer of record under contract to the State of Colorado for the Project identified in the Contract Documents.

4. OCCUPANCY. The term “Occupancy” means occupancy taken by the State as Owner after the Date of Substantial Completion at a time when a building or other discrete physical portion of the Project is used for the purpose intended. The Date of Occupancy shall be the date of such first use, but shall not be prior to the date of execution of the Notice of Approval of Occupancy/Use. Prior to the date of execution of a Notice of Approval of Occupancy/Use, the state shall have no right to occupy and the project may not be considered safe for occupancy for the intended use.

5. CHANGE ORDER. The term “Change Order” means a written order, signed by a Procurement Officer, directing the Contractor to make changes in the Work, in accordance with Article 35A, The Value of Changed Work.

6. COLORADO LABOR. The term “Colorado labor” shall be defined, as provided in § 8-17-101, C.R.S., as any person who is a resident of the state of Colorado, at the time of employment, without discrimination as to race, color, creed, sex, age, or religion except when sex or age is a bona fide occupational qualification, or shall have such other meaning as the term may otherwise be given in § 8-17-101, C.R.S., as amended.

7. CONTRACTOR. The word “Contractor” shall mean the person, company, firm, corporation or other legal entity entering into a contract with the State of Colorado acting by and through the Principal Representative.

8. DAYS. The term “days” whether singular or plural shall mean calendar days unless expressly stated otherwise. Where the term “business days” is used it shall mean business days of the State of Colorado.

9. DRAWINGS. The term “Drawings” shall mean all drawings approved by appropriate State officials which have been prepared by the Architect/Engineer showing the work to be done, except that where a list of drawings is specifically enumerated in the Supplementary General Conditions or division 1 of the Specifications, the term shall mean the drawings so enumerated, including all addenda drawings.

10. EMERGENCY FIELD CHANGE ORDER. The term “Emergency Field Change Order” shall mean a written change order for extra work or a change in the work necessitated by an emergency as defined in Article 35C executed on State form SC 6.31 and identified as an Emergency Field Change Order. The use of such orders is limited to emergencies and to the amounts shown in Article 35C.

11. FINAL ACCEPTANCE. The terms “final acceptance” or “finally complete” mean the stage in the progress of the work, after substantial completion, when all remaining items of work have been completed, all requirements of the Contract Documents are satisfied and the Notice of Acceptance can be issued. Discrete physical portions of the Project may be separately and partially deemed finally complete at the discretion of the Principal Representative when that portion of the Project reaches such stage of completion and a partial Notice of Acceptance can be issued.

12. NOTICE. The term “Notice” shall mean any communication in writing from either contracting party to the other by such means of delivery that receipt cannot properly be denied. Notice shall be provided to the person identified to receive it in Article 54E, Notice Identification, or to such other person as either party identifies in writing to receive Notice. Notice by facsimile transmission where proper transmission is evidence shall be adequate where facsimile numbers are included in Article 54E. Notwithstanding an email delivery or return receipt, email Notice shall not be adequate. Acknowledgment of receipt of a voice message shall not be deemed to waive the requirement that Notice, where required, shall be in writing.
13. **OWNER.** The term “Owner” shall mean the Principal Representative.

14. **PRINCIPAL REPRESENTATIVE.** The term “Principal Representative ” shall be defined, as provided in § 24-30-1301(11), C.R.S., as the governing board of a state department, institution, or agency; or if there is no governing board, then the executive head of a state department, institution, or agency, as designated by the governor or the general assembly and as specifically identified in the Contract Documents, or shall have such other meaning as the term may otherwise be given in § 24-30-1301(11), C.R.S., as amended. The Principal Representative may delegate authority. The Contractor shall have the right to inquire regarding the delegated authority of any of the Principal Representative’s representatives on the project and shall be provided with a response in writing when requested.

15. **PROCUREMENT OFFICER.** The term “Procurement Officer ” means any person duly authorized to enter into and administer contracts and make written determinations with respect thereto. “Procurement Officer” includes an authorized representative of the Principal Representative acting within the limits of his or her authority.

16. **PRODUCT DATA.** The term “Product Data ” shall mean all submittals in the form of printed manufacturer’s literature, manufacturer’s specifications, and catalog cuts.

17. **REASONABLY INFERABLE:** The phrase “reasonably inferable” means that if an item or system is either shown or specified, all material and equipment normally furnished with such items or systems and needed to make a complete installation shall be provided whether mentioned or not, omitting only such parts as are specifically excepted, and shall include only components which the Contractor could reasonably anticipate based on his or her skill and knowledge using an objective, industry standard, not a subjective standard. This term takes into consideration the normal understanding that not every detail is to be given on the Drawings and Specifications. The phrase shall not, however, be construed to make the Contractor, rather than the Architect/Engineer, responsible for producing the Drawings and Specifications.

18. **SAMPLES.** The term “Samples” shall mean examples of materials or work provided to establish the standard by which the Work will be judged.

19. **SC.** The term “SC” means “State Contract” which is used in connection with labeling applicable State form documents (e.g., “SC 6.23” is the State form number for these General Conditions of the Contract).

20. **SBP.** The term “SBP” means “State Buildings”, which is used in connection with labeling applicable State form documents (e.g., “SBP-01” is the form number for Notice of Approval of Occupancy/Use).

21. **SHOP DRAWINGS.** The term “Shop Drawings ” shall mean any and all detailed drawings prepared and submitted by Contractor, Subcontractor at any tier, vendors or manufacturers providing the products and equipment specified on the Drawings or called for in the Specifications.

22. **SPECIFICATIONS.** The term “Specifications ” shall mean the requirements of divisions 1 through 17 of the project manual prepared by the Architect/Engineer describing the work to be accomplished.

23. **STATE BUILDINGS PROGRAMS.** The term “State Buildings Programs” is the shortened name of the division of State Buildings Programs. It shall refer to the division of the executive department of State government responsible for project administration, review, approval and coordination of plans, construction procurement policy, contractual procedures, and code compliance and inspection of all buildings, public works and improvements erected for state purposes; except public roads and highways and projects under the supervision of the division of wildlife and the division of parks and outdoor recreation as provided in § 24-30-1301, et seq, C.R.S. The term State Buildings Programs shall also mean that individual within a State Department agency or institution, including institutions of higher education, who has signed an agreement accepting delegation to perform all or part of the responsibilities and functions of State Buildings Programs.

24. **SUBMITTALS.** The term “submittals” means drawings, lists, tables, documents and samples prepared by the Contractor to facilitate the progress of the work as required by these General Conditions or the Drawings and Specifications. They consist of Shop Drawings, Product Data, Samples, and various administrative support documents including but not limited to lists of subcontractors, construction progress schedules, schedules of values, applications for...
payment, inspection and test results, requests for information, various document logs, and as-
built drawings. Submittals are required by the Contract Documents, but except to the extent
expressly specified otherwise are not themselves a part of the Contract Documents.

25. SUBSTANTIAL COMPLETION. The terms “substantial completion” or “substantially complete
” mean the stage in the progress of the work when the construction is sufficiently complete, in
accordance with the Contract Documents as modified by any Change Orders, so that the Work,
or at the discretion of the Principal Representative, any designated portion thereof, is available
for its intended use by the Principal Representative and a Notice of Substantial Completion can
be issued. Portions of the Project may, at the discretion of the Principal Representative, be
designated as substantially complete.

26. SURETY. The term “Surety” shall mean the company providing the labor and material
payment and performance bonds for the Contractor as obligor.

27. WORK. The term “Work” shall mean all or part of the labor, materials, equipment, and other
services required by the Contract Documents or otherwise required to be provided by the
Contractor to meet the Contractor’s obligations under the Contract.

ARTICLE 2. EXECUTION, CORRELATION, INTENT OF DOCUMENTS, COMMUNICATION AND
COOPERATION

A. EXECUTION
The Contractor, within ten (10) days from the date of Notice of Award, will be required to:
1. Execute the Agreement, State Form SC-6.21;
2. Furnish fully executed Performance and Labor and Material Payment Bonds on State Form s
SC-6.22 and SC-6.221; and
3. Furnish certificates of insurance evidencing all required insurance on standard Acord forms
designed for such purpose.
4. Furnish certified copies of any insurance policies requested by the Principal Representative.

B. CORRELATION
By execution of the Agreement the Contractor represents that the Contractor has visited the site, has
become familiar with local conditions and local requirements under which the Work is to be performed,
including the building code programs of the State Buildings Program as implemented by the Principal
Representative, and has correlated personal observations with the requirements of the Contract
Documents.

C. INTENT OF DOCUMENTS
The Contract Documents are complementary, and what is called for by any one document shall be as
binding as if called for by all. The intention of the documents is to include all labor, materials,
equipment and transportation necessary for the proper execution of the Work. Words describing
materials or work which have a well-known technical or trade meaning shall be held to refer to such
recognized standards.

In any event, if any error exists, or appears to exist, in the requirements of the Drawings or
Specifications, or if any disagreement exists as to such requirements, the Contractor shall have the
same explained or adjusted by the Architect/Engineer before proceeding with the work in question. In
the event of the Contractor’s failure to give prior written Notice of any such errors or disagreements of
which the Contractor or the Subcontractors at any tier are aware, the Contractor shall, at no additional
cost to the Principal Representative, make good any damage to, or defect in, work which is caused by
such omission.

Where a conflict occurs between or within standards, Specifications or Drawings, which is not resolved
by reference to the precedence between the Contract Documents, the more stringent or higher quality
requirements shall apply so long as such more stringent or higher quality requirements are reasonably
inferable. The Architect/Engineer shall decide which requirements will provide the best installation.
With the exception noted in the following paragraph, the precedence of the Contract Documents is in
the following sequence:
1. The Agreement (SC-6.21);
2. The Supplementary General Conditions, if any;
3. The General Conditions (SC-6.23); and
4. Drawings and Specifications, all as modified by any addenda.

Change Orders and Amendments, if any, to the Contract Documents take precedence over the original Contract Documents.

Notwithstanding the foregoing order of precedence, the Special Provisions of Article 52 of the General Conditions, Special Provisions, shall take precedence, rule and control over all other provisions of the Contract Documents.

Unless the context otherwise requires, form numbers in this document are for convenience only. In the event of any conflict between the form required by name or context and the form required by number, the form required by name or context shall control. The Contractor may obtain State forms from the Principal Representative upon request.

D. PARTNERING, COMMUNICATIONS AND COOPERATION

In recognition of the fact that conflicts, disagreements and disputes often arise during the performance of construction contracts, the Contractor and the Principal Representative aspire to encourage a relationship of open communication and cooperation between the employees and personnel of both, in which the objectives of the Contract may be better achieved and issues resolved in a more fully informed atmosphere.

The Contractor and the Principal Representative each agree to assign an individual who shall be fully authorized to negotiate and implement a voluntary partnering plan for the purpose of facilitating open communications between them. Within thirty days (30) of the Notice to Proceed, the assigned individuals shall meet to discuss development of an informal agreement to accomplish these goals.

The assigned individuals shall endeavor to reach an informal agreement, but shall have no such obligation. Any plans these parties voluntarily agree to implement shall result in no change to the contract amount, and no costs associated with such plan or its development shall be recoverable under any contract clause. In addition, no plan developed to facilitate open communication and cooperation shall alter, amend or waive any of the rights or duties of either party under the Contract unless and except by written Amendment to the Contract, nor shall anything in this clause or any subsequently developed partnering plan be deemed to create fiduciary duties between the parties unless expressly agreed in a written Amendment to the Contract. It is also recognized that projects with relatively low contract values may not justify the expense or special efforts required. In the case of small projects with an initial Contract value under $500,000, the requirements of the preceding paragraph shall not apply.

ARTICLE 3. COPIES FURNISHED

The Contractor will be furnished, free of charge, the number of copies of Drawings and Specifications as specified in the Contract Documents, or if no number is specified, all copies reasonably necessary for the execution of the work.

ARTICLE 4. OWNERSHIP OF DRAWINGS

Drawings or Specifications, or copies of either, furnished by the Architect/Engineer, are not to be used on any other work. At the completion of the Work, at the written request of the Architect/Engineer, the Contractor shall endeavor to return all Drawings and Specifications.

The Contractor may retain the Contractor’s Contract Document set, copies of Drawings and Specifications used to contract with others for any portion of the Work and a marked up set of as-built drawings.
ARTICLE 5. ARCHITECT/ENGINEER'S STATUS
The Architect/Engineer is the representative of the Principal Representative for purposes of administration of the Contract, as provided in the Contract Documents and the Agreement. In case of termination of employment or the death of the Architect/Engineer, the Principal Representative will appoint a capable Architect/Engineer against whom the Contractor makes no reasonable objection, whose status under the Contract shall be the same as that of the former Architect/Engineer.

ARTICLE 6. ARCHITECT/ENGINEER DECISIONS AND JUDGMENTS, ACCESS TO WORK AND INSPECTION

A. DECISIONS
The Architect/Engineer shall, within a reasonable time, make decisions on all matters relating to the execution and progress of the Work or the interpretation of the Contract Documents, and in the exercise of due diligence shall be reasonably available to the Contractor to timely interpret and make decisions with respect to questions relating to the design or concerning the Contract Documents.

B. JUDGMENTS
The Architect/Engineer is, in the first instance, the judge of the performance required by the Contract Documents as it relates to compliance with the Drawings and Specifications and quality of workmanship and materials.

The Architect/Engineer shall make judgments regarding whether directed work is extra or outside the scope of Work required by the Contract Documents at the time such direction is first given. If, in the Contractor's judgment, any performance directed by the Architect/Engineer is not required by the Contract Documents or if the Architect/Engineer does not make the judgment required, it shall be a condition precedent to the filing of any claim for additional cost related to such directed work that the Contractor, before performing such work, shall first obtain in writing, the Architect/Engineer's written decision that such directed work is included in the performance required by the Contract Documents. If the Architect/Engineer's direction to perform the work does not state that the work is included in the performance required by the Contract Documents, the Contractor shall, in writing, request the Architect/Engineer to advise in writing whether the directed work will be considered extra work or work included in the performance required by the Contract Documents.

The Architect/Engineer shall respond to any such written request for such a decision within three (3) business days and if no response is provided, or if the Architect/Engineer's written decision is to the effect that the work is included in the performance required by the Contract Documents, the Contractor may file with the Principal Representative and the Architect/Engineer a Notice of claim in accordance with Article 36, Claims. Whether or not a Notice of claim is filed, the Contractor shall proceed with the ordered work. Disagreement with the decision of the Architect/Engineer shall not be grounds for the Contractor to refuse to perform the work directed or to suspend or terminate performance.

C. ACCESS TO WORK
The Architect/Engineer, the Principal Representative and representatives of State Buildings Programs shall at all times have access to the work. The Contractor shall provide proper facilities for such access and for their observations or inspection of the work.

D. INSPECTION
The Architect/Engineer has agreed to make, or that structural, mechanical, electrical engineers or other consultants will make, periodic visits to the site to generally observe the progress and quality of the Work to determine in general if the Work is proceeding in accordance with the Contract Documents. Observation may extend to all or any part of the Work and to the preparation, fabrication or manufacture of materials.

Without in any way meaning to be exclusive or to limit the responsibilities of the Architect/Engineer or the Contractor, the Architect/Engineer has agreed to observe, among other aspects of the Work, the following for compliance with the Contract Documents:
1. Bearing surfaces of excavations before concrete is placed based upon the findings and recommendations of the Principal Representative’s soils engineering consultant;
2. Reinforcing steel after installation and before concrete is poured;
3. Structural concrete;
4. Laboratory reports on all concrete testing based upon the findings and recommendations of the Principal Representative’s testing consultant;
5. Structural steel during and after erection and prior to its being covered or enclosed;
6. Steel welding; Principal Representative will furnish steel welding inspection consultant/agency if required or necessary for the project;
7. Mechanical and plumbing work following its installation and prior to its being covered or enclosed;
8. Electrical work following its installation and prior to its being covered or enclosed;
9. Compaction testing reports based upon the findings and recommendations of the Principal Representative’s testing consultant; and
10. Any special or quality control testing required in the Contract Documents provided by the Principal Representative’s testing consultant.

If the Specifications, the Architect/Engineer’s instructions, laws, ordinances of any public authority require any work to be specifically tested or approved, the Contractor shall give the Architect/Engineer timely notice of its readiness for observation by the Architect/Engineer or inspection by another authority, and if the inspection is by another authority, of the date fixed for such inspection, required certificates of inspection being secured by the Contractor. The Contractor shall give all required Notices to the Principal Representative or his or her designee for inspections required for the building inspection program. It shall be the responsibility of the Contractor to determine the Notice required by the State pursuant to Building Inspection Record for the Project, according to State form SBP-B.I.R., or the equivalent form required by the Principal Representative as approved by the State Buildings Program. If any such work is covered up without approval or consent of the Architect/Engineer or prior to any building code inspection, it must, if required by the Architect/Engineer, the Principal Representative or the State Buildings Programs, be uncovered for examination, at the Contractor’s expense. If such work is found to be not in accordance with the Contract Documents, the Contractor shall pay such costs, unless he or she shall show that the defect in the work was caused by another contractor engaged by the Principal Representative. In that event, the Principal Representative shall pay such cost. In addition, examination of questioned work may be ordered, and if so ordered, the work must be uncovered by the Contractor. If such work be found in accordance with the Contract Documents, the Contractor shall be reimbursed the cost of examination and replacement.

ARTICLE 7. CONTRACTOR’S SUPERINTENDENCE AND SUPERVISION
The Contractor shall employ, and keep present on the Project during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Architect/Engineer and the Principal Representative. The superintendent shall not be changed except with the consent of the Architect/Engineer and the Principal Representative, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his or her employ. The superintendent shall represent the Contractor in his or her absence and all directions given to the superintendent shall be as binding as if given to the Contractor. Directions received by the superintendent shall be documented by the superintendent and confirmed in writing with the Contractor.

The Contractor shall give efficient supervision to the Work, using his or her best skill and attention. He or she shall carefully study and compare all Drawings, Specifications and other written instructions and shall without delay report any error, inconsistency or omission which he or she may discover in writing to the Architect/Engineer. The Contractor shall not be liable to the Principal Representative for damage to the extent it results from errors or deficiencies in the Contract Documents or other instructions by the Architect/Engineer, unless the Contractor knew or had reason to know, that damage would result by proceeding and the Contractor fails to so advise the Architect/Engineer.

The superintendent shall see that the Work is carried out in accordance with the Contract Documents and in a uniform, thorough and first-class manner in every respect. The Contractor’s superintendent shall establish
all lines, levels, and marks necessary to facilitate the operations of all concerned in the Contractor’s Work. The Contractor shall lay out all work in a manner satisfactory to the Architect/Engineer, making permanent records of all lines and levels required for excavation, grading, foundations, and for all other parts of the Work.

ARTICLE 8. MATERIALS AND EMPLOYEES

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation and other facilities necessary for the execution and completion of the Work.

Unless otherwise specified, all materials shall be new and both workmanship and materials shall be first class and of uniform quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor is fully responsible for all acts and omissions of the Contractor’s employees and shall at all times enforce strict discipline and good order among employees on the site. The Contractor shall not employ on the Work any person reasonably deemed unfit by the Principal Representative or anyone not skilled in the work assigned to him.

ARTICLE 9. SURVEYS, PERMITS, LAWS, TAXES AND REGULATIONS

A. SURVEYS

The Principal Representative shall furnish all surveys, property lines and bench marks deemed necessary by the Architect/Engineer, unless otherwise specified.

B. PERMITS AND LICENSES

Permits and licenses necessary for the prosecution of the Work shall be secured and paid for by the Contractor. Unless otherwise specified in the Specifications, no local municipal or county building permit shall be required. However, State Buildings Programs requires each Principal Representative to administer a building code inspection program, the implementation of which may vary at each agency or institution of the State. The Contractors’ employees shall become personally familiar with these local conditions and requirements and shall fully comply with such requirements. State electrical and plumbing permits are required, unless the requirement to obtain such permits is altered by State Building’s Programs. The Contractor shall obtain and pay for such permits.

Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Principal Representative, unless otherwise specified.

C. TAXES

1. REFUND OF SALES AND USE TAXES

The Contractor shall pay all local taxes required to be paid, including but not necessarily limited to all sales and use taxes. If requested by the Principal Representative prior to issuance of the Notice to Proceed or directed in the Supplementary General Conditions or the Specifications, the Contractor shall maintain records of such payments in respect to the Work, which shall be separate and distinct from all other records maintained by the Contractor, and the Contractor shall furnish such data as may be necessary to enable the State of Colorado, acting by and through the Principal Representative, to obtain any refunds of such taxes which may be available under the laws, ordinances, rules or regulations applicable to such taxes. When so requested or directed, the Contractor shall require Subcontractors at all tiers to pay all local sales and use taxes required to be paid and to maintain records and furnish the Contractor with such data as may be necessary to obtain refunds of the taxes paid by such Subcontractors. No State sales and use taxes are to be paid on material to be used in this Project. On application by the purchaser or seller, the Department of Revenue shall issue to a Contractor or to a Subcontractor at any tier, a certificate or certificates of exemption per § 39-26-114(1)(d), C.R.S., and § 39-26-203, C.R.S.

2. FEDERAL TAXES
The Contractor shall exclude the amount of any applicable federal excise or manufacturers’ taxes from the proposal. The Principal Representative will furnish the Contractor, on request exemption certificates.

D. LAWS AND REGULATIONS
The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn or specified. If the Contractor observes that the Drawings or Specifications require work which is at variance therewith, the Contractor shall without delay notify the Architect/Engineer in writing and any necessary changes shall be adjusted as provided in Article 35, Changes In The Work.

The Contractor shall bear all costs arising from the performance of work required by the Drawings or Specifications that the Contractor knows to be contrary to such laws, ordinances, rules or regulations, if such work is performed without giving Notice to the Architect/Engineer.

ARTICLE 10. PROTECTION OF WORK AND PROPERTY
A. GENERAL PROVISIONS
The Contractor shall continuously maintain adequate protection of all work and materials, protect the property from injury or loss arising in connection with this Contract and adequately protect adjacent property as provided by law and the Contract Documents. The Contractor shall make good any damage, injury or loss, except to the extent:

1. Directly due to errors in the Contract Documents;
2. Caused by agents or employees of the Principal Representative; and,
3. Due to causes beyond the Contractor’s control and not to fault or negligence; provided such damage, injury or loss would not be covered by the insurance required to be carried by the Contractor;

B. SAFETY PRECAUTIONS
The Contractor shall take all necessary precautions for the safety of employees on the Project, and shall comply with all applicable provisions of federal, State and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the Work is being performed. He or she shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling materials; and he or she shall designate a responsible member of his or her organization on the Project, whose duty shall be the prevention of accidents. The name and position of any person so designated shall be reported to the Architect/Engineer by the Contractor.

The Contractor shall provide all necessary bracing, shoring and tying of all structures, decks and framing to prevent any structural failure of any material which could result in damage to property or the injury or death of persons; take all precautions to insure that no part of any structure of any description is loaded beyond its carrying capacity with anything that will endanger its safety at any time during the execution of this Contract; and provide for the adequacy and safety of all scaffolding and hoisting equipment. The Contractor shall not permit open fires within the building enclosure. The Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations and floors, pits and trenches free of water. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work, except as otherwise noted.

The Contractor shall take due precautions when obstructing sidewalks, streets or other public ways in any manner, and shall provide, erect and maintain barricades, temporary walkways, roadways, trench covers, colored lights or danger signals and any other devices necessary or required to assure the safe passage of pedestrians and automobiles.
C. EMERGENCIES

In an emergency affecting the safety of life or of the Work or of adjoining property, the Contractor without special instruction or authorization from the Architect/Engineer or Principal Representative, is hereby permitted to act, at his or her discretion, to prevent such threatened loss or injury; and he or she shall so act, without appeal, if so authorized or instructed. Provided the Contractor has no responsibilities for the emergency, if the Contractor incurs additional cost not otherwise recoverable from insurance or others on account of any such emergency work, the Contract sum shall be equitably adjusted in accordance with Article 35, Changes In The Work.

ARTICLE 11. DRAWINGS AND SPECIFICATIONS ON THE WORK

The Contractor shall keep on the job site one copy of the Contract Documents in good order, including current copies of all Drawings and Specifications for the Work, and any approved Shop Drawings, Product Data or Samples, and as-built drawings. As-built drawings shall be updated weekly by the Contractor and Subcontractors to reflect actual constructed conditions including dimensioned locations of underground work and the Contractor's failure to maintain such updates may be grounds to withhold portions of payments otherwise due in accordance with Article 33, Payments Withheld. All such documents shall be available to the Architect/Engineer and representatives of the State. In addition, the Contractor shall keep on the job site one copy of all approved addenda, Change Orders and requests for information issued for the Work.

The Contractor shall develop procedures to insure the currency and accuracy of as-built drawings and shall maintain on a current basis a log of requests for information and responses thereto, a Shop Drawing and Product Data submittal log, and a Sample submittal log to record the status of all necessary and required submittals.

ARTICLE 12. REQUESTS FOR INFORMATION AND SCHEDULES

A. REQUESTS FOR INFORMATION

The Architect/Engineer shall furnish additional instructions with reasonable promptness, by means of drawings or otherwise, necessary for the proper execution of the Work. All such drawings and instructions shall be consistent with the Contract Documents and reasonably inferable there from. The Architect/Engineer shall determine what additional instructions or drawings are necessary for the proper execution of the Work.

The Work shall be executed in conformity with such instructions and the Contractor shall do no work without proper drawings, specifications or instructions. If the Contractor believes additional instructions, specifications or drawings are needed for the performance of any portion of the Work, the Contractor shall give Notice of such need in writing through a request for information furnished to the Architect/Engineer sufficiently in advance of the need for such additional instructions, specifications or drawings to avoid delay and to allow the Architect/Engineer a reasonable time to respond. The Contractor shall maintain a log of the requests for information and the responses provided.

B. SCHEDULES

1. SUBMITTAL SCHEDULES

Prior to filing the Contractor’s first application for payment, a schedule shall be prepared which may be preliminary to the extent required, fixing the dates for the submission and initial review of required Shop Drawings, Product Data and Samples for the beginning of manufacture and installation of materials, and for the completion of the various parts of the Work. It shall be prepared so as to cause no delay in the Work or in the work of any other contractor. The schedule shall be subject to change from time to time in accordance with the progress of the Work, and it shall be subject to the review and approval by the Architect/Engineer. It shall fix the dates at which the various Shop Drawings Product Data and Samples will be required from the Architect/Engineer. The Architect/Engineer, after review and agreement as to the time provided for initial review, shall review and comment on the Shop Drawings, Product Data and Samples in accordance with that schedule. The schedule shall be finalized, prepared and submitted with respect to each of the elements of the Work in time to avoid delay, considering reasonable periods for review, manufacture or installation.
At the time the schedule is prepared, the Contractor, the Architect/Engineer and Principal Representative shall jointly identify the Shop Drawing, Product Data and Samples, if any, which the Principal Representative shall receive simultaneously with the Architect/Engineer for the purposes of owner coordination with existing facility standards and systems. The Contractor shall furnish a copy for the Principal Representative when so requested. Transmittal of Shop Drawings and Product Data copies to the Principal Representative shall be solely for the convenience of the Principal Representative and shall neither create nor imply responsibility or duty of review by the Principal Representative.

The Contractor may also, or at the direction of the Principal Representative at any time shall, prepare and maintain a schedule, which may also be preliminary and subject to change to the extent required, fixing the dates for the initial responses to requests for information or for detail drawings which will be required from the Architect/Engineer to allow the beginning of manufacture, installation of materials and for the completion of the various parts of the Work. The schedule shall be subject to review and approval by the Architect/Engineer. The Architect/Engineer shall, after review and agreement, furnish responses and detail drawings in accordance with that schedule. Any such schedule shall be prepared and approved in time to avoid delay, considering reasonable periods for review, manufacture or installation, but so long as the request for information schedule is being maintained, it shall not be deemed to transfer responsibility to the Contractor for errors or omissions in the Contract Documents where circumstances make timely review and performance impossible.

The Architect/Engineer shall not unreasonably withhold approval of the Contractor’s schedules and shall inform the Contractor and the Principal Representative of the basis of any refusal to agree to the Contractor’s schedules. The Principal Representative shall attempt to resolve any disagreements.

2. SCHEDULE OF VALUES
Within twenty-one (21) calendar days after the date of the Notice to Proceed, the Contractor shall submit to the Architect/Engineer and Principal Representative, for approval, and to the State Buildings Programs when specifically requested, a complete itemized schedule of the values of the various parts of the Work, as estimated by the Contractor, aggregating the total price. The schedule of values shall be in such detail as the Architect/Engineer or the Principal Representative shall require, prepared on forms acceptable to the Principal Representative. It shall, at a minimum, identify on a separate line each division of the Specifications including the general conditions costs to be charged to the Project. The Contractor shall revise and resubmit the schedule of values for approval when, in the opinion of the Architect/Engineer or the Principal Representative, such resubmittal is required due to changes or modifications to the Contract Documents or the Contract sum.

The total cost of each line item so separately identified shall, when requested by the Architect/Engineer or the Principal Representative, be broken down into reasonable estimates of the value of:
   a. Material, which shall include the cost of material actually built into the Project plus any local sales or use tax paid thereon; and,
   b. Labor and other costs.

The cost of subcontracts shall be incorporated in the Contractor’s schedule of values, and when requested by the Architect/Engineer or the Principal Representative, shall be separately shown as line items.

The Architect/Engineer shall review the proposed schedules and approve it after consultation with the Principal Representative, or advise the Contractor of any required revisions within ten (10) days of its receipt. In the event no action is taken on the submittal within ten days, the
Contractor may utilize the schedule of values as its submittal for payment until it is approved or until revisions are requested.

When the Architect/Engineer deems it appropriate to facilitate certification of the amounts due to the Contractor, further breakdown of subcontracts, including breakdown by labor and materials, may be directed.

This schedule of values, when approved, will be used in preparing Contractor's applications for payment on State Form SC-7.2, Application for Payment.

3. CONSTRUCTION SCHEDULES
Within twenty-one (21) calendar days after the date of the Notice to Proceed, the Contractor shall submit to the Architect/Engineer and the Principal Representative, and to the State Buildings Programs when specifically requested, on a form acceptable to them, an overall timetable of the construction schedule for the Project. Unless the Supplementary General Conditions or the Specifications allow scheduling with bar charts or other less sophisticated scheduling tools, the Contractor's schedule shall be a critical-path method (CPM) construction schedule. The CPM schedule shall start with the date of the Notice to Proceed and include submittals activities, the various construction activities, change order work (when applicable), close-out, testing, demonstration of equipment operation when called for in the Specifications, and acceptance. The CPM shall at a minimum correlate to the schedule of values line items and shall be cost loaded if requested by the Architect/Engineer or Principal Representative. The completion time shall be the time specified in the Agreement and all Project scheduling shall allocate float utilizing the full period available for construction as specified in the Agreement on State Form SC 6.13, without indication of early completion, unless such earlier completion is approved in writing by the Principal Representative and State Building Programs.

The time shown between the starting and completion dates of the various elements within the construction schedule shall represent one hundred per cent (100%) completion of each element.

All other elements of the CPM schedule shall be as required by the Specifications. In addition, the Contractor shall submit monthly updates of the construction schedule. These updates shall reflect the Contractor's "work in place" progress.

When requested by the Architect/Engineer, the Principal Representative or the State Buildings Programs, the Contractor shall revise the construction schedule to reflect changes in the schedule of values.

When the testing of materials is required by the Specifications, the Contractor shall also prepare and submit to the Architect/Engineer and the Principal Representative a schedule for testing in accordance with Article 14, Samples and Testing.

ARTICLE 13. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
A. SUBMITTAL PROCESS
The Contractor shall check and field verify all dimensions. The Contractor shall check, approve and submit to the Architect/Engineer in accordance with the schedule described in Article 12, Requests for Information and Schedules, all Shop Drawings, Product Data and Samples required by the specifications or required by the Contractor for the work of the various trades. All Drawings and Product Data shall contain identifying nomenclature and each submittal shall be accompanied by a letter of transmittal identifying in detail all enclosures. The number of copies of Shop Drawings and Product Data to be submitted shall be as specified in the Specifications and if no number is specified then three copies shall be submitted.

The Architect/Engineer shall review and comment on the Shop Drawings and Product Data within the time provided in the agreed upon schedule for conformance with information given and the design
concept expressed in, or reasonably inferred from, the Contract Documents. The nature of all corrections to be made to the Shop Drawings and Product Data, if any, shall be clearly noted, and the submittals shall be returned to the Contractor for such corrections. If a change in the scope of the Work is intended by revisions requested to any Shop Drawings and Product Data, the Contractor shall be requested to prepare a change proposal in accordance with Article 35, Changes In The Work. On resubmitted Shop Drawings, Product Data or Samples, the Contractor shall direct specific attention in writing on the transmittal cover to revisions other than those corrections requested by the Architect/Engineer on any previously checked submittal. The Architect/Engineer shall promptly review and comment on, and return, the resubmitted items.

The Contractor shall thereafter furnish such other copies in the form approved by the Architect/Engineer as may be needed for the prosecution of the work.

B. FABRICATION AND ORDERING
Fabrication shall be started by the Contractor only after receiving approved Shop Drawings from the Architect/Engineer. Materials shall be ordered in accordance with approved Product Data. Work which is improperly fabricated, whether through incorrect Shop Drawings, faulty workmanship or materials, will not be acceptable.

C. DEVIATIONS FROM DRAWINGS OR SPECIFICATIONS
The review and comments of the Architect/Engineer of Shop Drawings, Product Data or Samples shall not relieve the Contractor from responsibility for deviations from the Drawings or Specifications, unless he or she has in writing called the attention of the Architect/Engineer to such deviations at the time of submission, nor shall it relieve the Contractor from responsibility for errors of any sort in Shop Drawings or Product Data. Review and comments on Shop Drawings or Product Data containing identified deviations from the Contract Documents shall not be the basis for a Change Order or a claim based on a change in the scope of the Work unless Notice is given to the Architect/Engineer and Principal Representative of all additional costs, time and other impacts of the identified deviation by bring it to their attention in writing at the time the submittals are made, and any subsequent change in the Contract sum or the Contract time shall be limited to cost, time and impacts so identified.

D. CONTRACTOR REPRESENTATIONS
By preparing, approving, and/or submitting Shop Drawings, Product Data and Samples, the Contractor represents that the Contractor has determined and verified all materials, field measurements, and field construction criteria related thereto, and has checked and co-ordinated the information contained within each submittal with the requirements of the Work, the Project and the Contract Documents and prior reviews and approvals.

ARTICLE 14. SAMPLES AND TESTING
A. SAMPLES
The Contractor shall furnish for approval, with such promptness as to cause no delay in his or her work or in that of any other Contractor, all Samples as directed by the Architect/Engineer. The Architect/Engineer shall check and approve such Samples, with reasonable promptness, but only for conformance with the design intent of the Contract Documents and the Project, and for compliance with any submission requirements given in the Contract Documents.

B. TESTING - GENERAL
The Contractor shall provide such equipment and facilities as the Architect/Engineer may require for conducting field tests and for collecting and forwarding samples to be tested. Samples themselves shall not be incorporated into the Work after approval without the permission of the Architect/Engineer.

All materials or equipment proposed to be used may be tested at any time during their preparation or use. The Contractor shall furnish the required samples without charge and shall give sufficient Notice of the placing of orders to permit the testing thereof. Products may be sampled either prior to shipment or after being received at the site of the Work.
Tests shall be made by an accredited testing laboratory. Except as otherwise provided in the Specifications, sampling and testing of all materials, and the laboratory methods and testing equipment, shall be in accordance with the latest standards and tentative methods of the American Society of Testing Materials (ASTM). The cost of testing which is in addition to the requirements of the Specifications shall be paid by the Contractor if so directed by the Architect/Engineer, and the Contract sum shall be adjusted accordingly by Change Order; provided however, that whenever testing shows portions of the Work to be deficient, all costs of testing including that required to verify the adequacy of repair or replacement work shall be the responsibility of the Contractor.

C. TESTING - CONCRETE AND SOILS

Unless otherwise specified or provided elsewhere in the Contract Documents, the Principal Representative will contract for and pay for the testing of concrete and for soils compaction testing through an independent laboratory or laboratories selected and approved by the Principal Representative. The Contractor shall assume the responsibility of arranging, scheduling and coordinating the concrete sample collection efforts and soils compaction efforts. Testing shall be performed in accordance with the requirements of the Specifications, and if no requirements are specified, the Contractor shall request instructions and testing shall be as directed by the Architect/Engineer or the soils engineer, as applicable, and in accordance with standard industry practices.

The Principal Representative and the Architect/Engineer shall be given reasonable advance notice of each concrete pour and reserve the right to either increase or decrease the number of cylinders or the frequency of tests.

Soil compaction testing shall be at random locations selected by the soils engineer. In general, soils compaction testing shall be as directed by the soils engineer and shall include all substrate prior to backfill or construction.

D. TESTING - OTHER

Additional testing required by the Specifications will be accomplished and paid for by the Principal Representative in a manner similar to that for concrete and soils unless noted otherwise in the Specifications. In any case, the Contractor will be responsible for arranging, scheduling and coordinating additional tests. Where the additional testing will be contracted and paid for by the Principal Representative the Contractor shall give the Principal Representative not less than one month advance written Notice of the date the first such test will be required.

ARTICLE 15. SUBCONTRACTS

The Contractor shall, within twenty one (21) days after the date of the Notice of Award, submit to the Architect/Engineer, the Principal Representative and State Buildings Programs a preliminary list of Subcontractors. It shall be as complete as possible at the time, showing all known Subcontractors planned for the work. The list shall be supplemented as other Subcontractors are determined by the Contractor and any such supplemental list shall be submitted to the Architect/Engineer, the Principal Representative and State Buildings Programs not less than ten (10) days before the Subcontractor commences work.

The Contractor's list shall include those Subcontractors, if any, which the Contractor indicated in its bid would be employed for specific portions of the Work if such indication was requested in the bid documents issued by the State. The substitution of any Subcontractor listed in the Contractor's bid shall be justified in writing not less than ten (10) days after the date of the Notice of Award, and shall be subject to the approval of the Principal Representative. For reasons such as the Subcontractor's refusal to perform as agreed, subsequent unavailability or later discovered bid errors, or other similar reasons, but not including the availability of a lower Subcontract price, such substitution may be approved. The Contractor shall bear any additional cost incurred by such substitutions.

The Contractor shall not employ any Subcontractor that the Architect/Engineer, within seven (7) days after the date of receipt of the Contractor's list of Subcontractors or any supplemental list, objects to in writing as being unacceptable to either the Architect/Engineer, the Principal Representative or State Buildings.
Programs. If a Subcontractor is deemed unacceptable, the Contractor shall propose a substitute Subcontractor and the Contract sum shall be adjusted by any demonstrated difference between the Subcontractor's bids, except where the Subcontractor has been debarred by the State or fails to meet qualifications of the Contract Documents to perform the work proposed.

The Contractor shall be fully responsible to the Principal Representative for the acts and omissions of Subcontractors and of persons either directly or indirectly employed by them. All instructions or orders in respect to work to be done by Subcontractors shall be given to the Contractor.

ARTICLE 16. RELATIONS OF CONTRACTOR AND SUBCONTRACTOR
The Contractor agrees to bind each Subcontractor to the terms of these General Conditions and to the requirements of the Drawings and Specifications, and any Addenda thereto, and also all the other Contract Documents, so far as applicable to the work of such Subcontractor. The Contractor further agrees to bind each Subcontractor to those terms of the General Conditions which expressly require that Subcontractors also be bound, including without limitation, requirements that Subcontractors waive all rights of subrogation, provide adequate general commercial liability and property insurance, automobile insurance and workers' compensation insurance as provided in Article 25, Insurance.

Nothing contained in the Contract Documents shall be deemed to create any contractual relationship whatsoever between any Subcontractor and the State of Colorado acting by and through its Principal Representative.

ARTICLE 17. MUTUAL RESPONSIBILITY OF CONTRACTORS
Should the Contractor cause damage to any separate contractor on the work, the Contractor agrees, upon due Notice, to settle with such contractor by agreement, if he or she will so settle. If such separate contractor sues the Principal Representative on account of any damage alleged to have been so sustained, the Principal Representative shall notify the Contractor, who shall defend such proceedings if requested to do so by Principal Representative. If any judgment against the Principal Representative arises there from, the Contractor shall pay or satisfy it and pay all costs and reasonable attorney fees incurred by the Principal Representative, in accordance with Article 52C, Indemnification, provided the Contractor was given due Notice of an opportunity to settle.

ARTICLE 18. SEPARATE CONTRACTS
The Principal Representative reserves the right to enter into other contracts in connection with the Project or the Contract. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his or her work with theirs. If any part of the Contractor's work depends, for proper execution or results, upon the work of any other contractor, the Contractor shall inspect and promptly report to the Architect/Engineer any defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of work, except as to defects which may develop in the other Contractor's work after the execution of the Contractor's work.

To insure the proper execution of subsequent work, the Contractor shall measure work already in place and shall at once report to the Architect/Engineer any discrepancy between the executed work and the Drawings.

ARTICLE 19. USE OF PREMISES
The Contractor shall confine apparatus, the storage of materials and the operations of workmen to limits indicated by law, ordinances, permits and any limits lines shown on the Drawings. The Contractor shall not unreasonably encumber the premises with materials.

The Contractor shall enforce all of the Architect/Engineer's instructions and prohibitions regarding, without limitation, such matters as signs, advertisements, fires and smoking.
ARTICLE 20. CUTTING, FITTING OR PATCHING
The Contractor shall do all cutting, fitting or patching of work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors shown upon, or reasonably inferred from, the Drawings and Specifications for the complete structure, and shall provide for such finishes to patched or fitted work as the Architect/Engineer may direct. The Contractor shall not endanger any work by cutting, excavating or otherwise altering the work and shall not cut or alter the work of any other Contractor save with the consent of the Architect/Engineer.

ARTICLE 21. UTILITIES
A. TEMPORARY UTILITIES
Unless otherwise specifically stated in the Specifications or on the Drawings, the Principal Representative shall be responsible for the locations of all utilities as shown on the Drawings or indicated elsewhere in the Specifications, subject to the Contractor's compliance with all statutory or regulatory requirements to call for utility locates. When actual conditions deviate from those shown the Contractor shall comply with the requirements of Article 37, Differing Site Conditions. The Contractor shall provide and pay for the installation of all temporary utilities required to supply all the power, light and water needed by him and other Contractors for their Work and shall install and maintain all such utilities in such manner as to protect the public and workmen and conform with any applicable laws and regulations. Upon completion of the work, he or she shall remove all such temporary utilities from the site. The Contractor shall pay for all consumption of power, light and water used by him or her and the other Contractors, without regard to whether such items are metered by temporary or permanent meters. The Superintendent shall have full authority over all trades and Subcontractors at any tier to prevent waste. The cut-off date on permanent meters shall be either the agreed date of the date of the Notice of Substantial Completion or the Notice of Approval of Occupancy/Use of the Project.

B. PROTECTION OF EXISTING UTILITIES
Where existing utilities, such as water mains, sanitary sewers, storm sewers and electrical conduits, are shown on the Drawings, the Contractor shall be responsible for the protection thereof, without regard to whether any such utilities are to be relocated or removed as a part of the Work. If any utilities are to be moved, the moving must be conducted in such manner as not to cause undue interruption or delay in the operation of the same.

C. CROSSING OF UTILITIES
When new construction crosses highways, railroads, streets, or utilities under the jurisdiction of State, city or other public agency, public utility or private entity, the Contractor shall secure proper written permission before executing such new construction. The Contractor will be required to furnish a proper release before final acceptance of the Work.

ARTICLE 22. UNSUITABLE CONDITIONS
The Contractor shall not work at any time, or permit any work to be done, under any conditions contrary to those recommended by manufacturers or industry standards which are otherwise proper, unsuited for proper execution, safety and performance. Any cost caused by ill-timed work shall be borne by the Contractor unless the timing of such work shall have been directed by the Architect/Engineer or the Principal Representative, after the award of the Contract, and the Contractor provided Notice of any additional cost.

ARTICLE 23. TEMPORARY FACILITIES
A. OFFICE FACILITIES
The Contractor shall provide and maintain without additional expense for the duration of the Project temporary office facilities, as required and as specified, for his or her own use and the use of the Architect/Engineer, representatives of the Principal Representative and State Buildings Programs.

B. TEMPORARY HEAT
The Contractor shall furnish and pay for all the labor, facilities, equipment, fuel and power necessary to supply temporary heating, ventilating and air conditioning, except to the extent otherwise specified, and shall be responsible for the installation, operation, maintenance and removal of such facilities and
equipment. Unless otherwise specified, the permanent HVAC system shall not be used for temporary heat in whole or in part. If the Contractor desires to put the permanent system into use, in whole or in part, the Contractor shall set it into operation and furnish the necessary fuel and manpower to safely operate, protect and maintain that HVAC system. Any operation of all or any part of the permanent HVAC system including operation for testing purposes shall not constitute acceptance of the system, nor shall it relieve the Contractor of his or her one-year guarantee of the system from the date of the Notice of Substantial Completion of the entire Project, and if necessary due to prior operation, the Contractor shall provide manufacturers’ extended warranties from the date of the Contractor’s use prior to the date of the Notice of Substantial Completion.

C. WEATHER PROTECTION
The Contractor shall, at all times, provide protection against weather, so as to maintain all work, materials, apparatus and fixtures free from injury or damages.

D. DUST PARTITIONS
If the Work involves work in an occupied existing building, the Contractor shall erect and maintain during the progress of the work, suitable dust-proof temporary partitions, or more permanent partitions as specified, to protect such building and the occupants thereof.

E. BENCH MARKS
The Contractor shall maintain any site bench marks provided by the Principal Representative and shall establish any additional benchmarks specified by the Architect/Engineer as necessary for the Contractor to layout the work and ascertain all grades and levels as needed.

F. SIGN
The Contractor shall erect and permit one 4’ x 8’ sign only at the site to identify the Project as specified or directed by the Architect/Engineer which shall be maintained in good condition during the life of the Project.

G. SANITARY PROVISION
The Contractor shall provide and maintain suitable, clean, temporary sanitary toilet facilities for any and all workmen engaged on the Work, for the entire construction period, in strict compliance with the requirement of all applicable codes, regulations, laws and ordinances, and no other facilities, new or existing, may be used by any person on the Project. When the Project is complete the Contractor shall promptly remove them from the site, disinfect, and clean or treat the areas as required. If any new construction surfaces in the Project other than the toilet facilities provided for herein are soiled at any time, the entire areas so soiled shall be completely removed from the Project and rebuilt.

ARTICLE 24. CLEANING UP
The Contractor shall keep the building and premises free from all surplus material, waste material, dirt and rubbish caused by employees or work, and at the completion of the Work shall remove all such surplus material, waste material, dirt, and rubbish, as well as all tools, equipment and scaffolding, and shall wash and clean all window glass and plumbing fixtures, perform cleanup and cleaning required by the Specifications and leave all of the work clean unless more exact requirements are specified.

ARTICLE 25. INSURANCE
A. GENERAL LIABILITY, PROPERTY DAMAGE AND AUTOMOBILE
The Contractor shall procure and maintain comprehensive commercial general liability and property damage insurance and comprehensive automobile liability and property damage insurance as hereinafter specified, at his or her own expense, during the life of this Contract. This insurance shall include a provision preventing cancellation without forty-five (45) days’ prior Notice by certified mail and shall state whether the coverage is “claims made” or “per occurrence”. The Contractor shall obtain “per occurrence” insurance unless otherwise agreed in writing by the Principal Representative. A completed Certificate of Insurance shall be filed with State Buildings Programs within ten (10) days after the date of the Notice of Award, said Certificate to specifically state the inclusion of the coverages and provisions set forth herein.
This insurance must protect the Contractor from all claims for bodily injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with, any operations under this Contract, whether such operations be by the Contractor or by any Subcontractor under him or anyone directly or indirectly employed by the Contractor or by a Subcontractor. All such insurance shall be written with limits and coverages as specified below and shall be written on a Comprehensive Form of Policy. In the event any of the hazards or exposures, normally listed in standard policies as “Exclusions”, are involved or required under this Contract, then such hazards or exposures shall be covered and protection afforded under the policy and such exclusions (X), (c) and (u), as excerpted from standard policies, must be removed from the policy as listed below:

"(X) Injury to or destruction of any property arising out of blasting or explosion, other than the explosion of air or steam vessels, piping under pressure, prime movers, machinery of power transmitting equipment"

"(c) The collapse of or structural injury to any building or structure due to: (1) grading of land, excavating, burrowing, filling, backfilling, tunneling, pile driving, cofferdam work or caisson work; or (2) moving, shoring, underpinning, raising or demolition of any building or structure, or removal or rebuilding of any structural support thereof;"

"(u) (1) injury to or destruction of wires, conduits, pipes, mains, sewers or other similar property, or any apparatus in connection therewith, below the surface of the ground, if such injury or destruction is caused by and occurs during the use of mechanical equipment for the purpose of grading of land, paving, excavating or drilling; or, (2) injury to or destruction of property at any time resulting there from."

Such insurance shall be written with limits and coverages as follows, and the State of Colorado shall be named as an additional insured listed on the Acord form. The additional insured endorsement shall be requested on Insurance Services Office, Inc. (ISO) endorsement form No. CG20101185. If CG20101185 is not available, the endorsement shall be furnished by CG20101093. Additionally, CG20371001 shall be included, if possible. All aggregate amounts must be specified on the Acord form.

A. **Commercial General Liability (CGL)**, (including bodily injury, personal injury and property damage) with the following coverages depending upon format:

1. Occurrence basis policy-combined single limit of $1,000,000
2. Annual Aggregate limit policy-not less than $2,000,000
   (Acord example) Minimum limits: $1,000,000 each occurrence
   $2,000,000 general aggregate with dedicated limits per project site
   $2,000,000 products and completed operations aggregate

The following coverages shall be included in the CGL:

1. Premises-Operations
2. Explosion/Collapse Hazard
3. Underground Hazard
4. Products/Completed Operations Hazard
5. Broad Form Contractual
6. Independent Contractors
7. Broad Form Property Damage
8. Personal Injury
B. **Automobile Liability** and business auto liability covering liability arising out of any auto (including owned, hired and non-owned autos).

   Occurrence basis policy-combined single limit of $1,000,000
   
   (Acord example) Minimum limit: $1,000,000 combined single limit each accident

   Coverages:
   
   1. Specific waiver of subrogation
   2. Contractual liability

C. **Umbrella/Excess Liability (for construction projects exceeding $10,000,000, provide the following coverage):** The vendor shall maintain umbrella/excess liability insurance on an occurrence basis in excess of the underlying insurance described in Sections A, B, and D, which is at least as broad as each and every area of the underlying policies. The amounts of insurance required in Sections A, B, and D may be satisfied by the vendor purchasing coverage for the limits specified or by any combination of underlying and umbrella limits, so long as the total amount of insurance is not less than the limits specified in each section previously mentioned.

   (Acord example) Minimum limit: $5,000,000 combined single limit and aggregate limit

   Coverages:
   
   1. Additional insured endorsement
   2. Pay on behalf of wording
   3. Concurrency of effective dates with primary
   4. Blanket contractual liability
   5. Punitive damages coverage (where not prohibited by law)

B. **WORKERS’ COMPENSATION INSURANCE**

The Contractor shall procure and maintain Workers’ Compensation Insurance at his or her own expense during the life of this Contract, including occupational disease provisions for all employees. This insurance, if issued by a private carrier, shall contain the same forty-five (45) days’ Notice of cancellation as required in Article 25, Insurance for the Comprehensive General Liability Insurance. Evidence of such insurance shall be by the issuance of either a Certificate by the State Compensation Insurance Fund (or its successor) or, if issued by a private carrier, the completion of a Certificate of Insurance, and such Certificate shall be filed with the State Buildings Program. The Certificate shall be filed within ten (10) days after the date of the Notice of Award.

The Contractor shall also require each Subcontractor to furnish Workers’ Compensation Insurance, including occupational disease provisions for all of the latter’s employees, and to the extent not furnished, the Contractor accepts full liability and responsibility for Subcontractor’s employees.

In cases where any class of employees engaged in hazardous work under this Contract at the site of the Project is not protected under the Workers’ Compensation statute, the Contractor shall provide, and shall cause each Subcontractor to provide, adequate and suitable insurance for the protection of employees not otherwise protected.
C. **BUILDER’S RISK INSURANCE**

Unless otherwise expressly stated in the Supplementary General Conditions (e.g. where the State elects to provide for projects with a completed value of less than $1,000,000), the Contractor shall effect and maintain a policy of insurance to provide, at Contractor’s expense, All Risk Builder’s Risk Insurance Coverage which shall be in the dollar amount of the total Project for which the Work of this Contract is to be done. Such policy may have a deductible clause but not to exceed ten thousand dollars ($10,000.00).

The Contractor shall waive all rights of subrogation as regards the State of Colorado, its officials, its officers, its agents and its employees, all while acting within the scope and course of their employment. The Insurer shall not void such insurance policy by reason of the Contractor waiving said rights. The Contractor shall require all Subcontractors at any tier to similarly waive all such rights of subrogation and shall expressly include such a waiver in all subcontracts. The insurance shall remain in effect until the date of Notice specified on the Notice of Acceptance, State Form SBP-6.27, whether or not the building or some part thereof is occupied in any manner prior to final acceptance of the Project, and shall remain fully in effect notwithstanding any acceptance of the work of any Subcontractor on the Project. Such insurance shall be in an amount equal to the total insurable value of the construction. Upon request, the amount of such insurance shall be increased to include the cost of any additional work to be done on the Project, or materials or equipment to be incorporated in the Project, or materials or equipment to be incorporated in the Project, under other independent contracts let or to be let. In such event, the Contractor shall be reimbursed for this cost as his or her share of the insurance in the same ratio as the ratio of the insurance represented by such independent contracts let or to be let to the total insurance carried.

All such insurance shall insure the State of Colorado acting by and through its Principal Representative, the Contractor and his or her Subcontractors at any tier as their interests may appear. The insurance shall include a loss payable provision naming the State Controller, as loss payee.

The Principal Representative, with approval of the State Controller, shall have the power to adjust and settle any loss. Unless it is agreed otherwise, all monies received shall be applied first on rebuilding or repairing the destroyed or injured work.

The Certificate of Insurance shall specifically state the inclusion of the provisions herein above. A certificate for such insurance shall be filed with State Buildings Programs within ten (10) days after date of Notice of Award. The Insurance shall include a provision preventing cancellation without forty five (45) days’ prior Notice in writing by certified mail.

D. **ADDITIONAL MISCELLANEOUS INSURANCE PROVISIONS**

Certificates of Insurance and/or insurance policies required under this Contract shall be subject to the following stipulations and additional requirements:

1. The clause entitled “Other Insurance Provisions” contained in any policy including the State of Colorado as an additional named insured shall not apply to the State of Colorado;
2. Any and all deductibles or self-insured retentions contained in any Insurance policy shall be assumed by and at the sole risk of the Contractor;
3. If any of the said policies shall fail at any time to meet the requirements of the Contract Documents as to form or substance, or if a company issuing any such policy shall be or at any time cease to be approved by the Division of Insurance of the State of Colorado, or be or cease to be in compliance with any stricter requirements of the Contract Documents, the Contractor shall promptly obtain a new policy, submit the same to State Building Programs for approval if requested, and submit a Certificate of Insurance as hereinbefore provided. Upon failure of the Contractor to furnish, deliver and maintain such insurance as provided herein, this Contract, in the sole discretion of the State of Colorado, may be immediately declared suspended, discontinued, or terminated. Failure of the Contractor in obtaining and/or maintaining any required insurance shall not relieve the Contractor from any liability under the Contract, nor
shall the insurance requirements be construed to conflict with the obligations of the Contractor concerning indemnification;

4. All requisite insurance shall be obtained from financially responsible insurance companies, authorized to do business in the State of Colorado and acceptable to the State;

5. Receipt, review, or acceptance by the State of any insurance policies or certificates of insurance required by this Contract shall not be construed as a waiver or relieve the Contractor from its obligation to meet the insurance requirements contained in these General Conditions.

ARTICLE 26. CONTRACTOR’S PERFORMANCE AND PAYMENT BONDS
The Contractor shall furnish a Performance Bond and a Labor and Material Payment Bond on State Forms SC-6.22, Performance Bond, and SC-6.221, Labor and Material Payment Bond, or such other forms as State Buildings Programs may approve for the Project, executed by a corporate Surety authorized to do business in the State of Colorado and in the full amount of the Contract sum. The expense of these bonds shall be borne by the Contractor and the bonds shall be filed with State Buildings Programs.

If, at any time, a Surety on such a bond is found to be, or ceases to be in strict compliance with any qualification requirements of the Contract Documents or the bid documents, or loses its right to do business in the State of Colorado, another Surety will be required, which the Contractor shall furnish to State Buildings Programs within ten (10) days after receipt of Notice from the State or after the Contractor otherwise becomes aware of such conditions.

ARTICLE 27. LABOR AND WAGES
In accordance with laws of Colorado, C.R.S. § 8-17-101, et. seq., as amended, Colorado labor shall be employed to perform the work to the extent of not less than eighty percent (80%) of each type or class of labor in the several classifications of skilled and common labor employed on the Project. If the Federal Davis-Bacon Act shall be applicable to the Project, as indicated in Article 54B, Modification of Article 27, the minimum wage rates to be paid on the Project will be specified in the Contract Documents.

ARTICLE 28. ROYALTIES AND PATENTS
The Contractor shall be responsible for assuring that all rights to use of products and systems have been properly arranged and shall take such action as may be necessary to avoid delay, at no additional charge to the Principal Representative, where such right is challenged during the course of the work. The Contractor shall pay all royalties and license fees required to be paid and shall defend all suits or claims for infringement of any patent rights and shall save the State of Colorado harmless from loss on account thereof, in accordance with Article 52C, Indemnification; provided, however, the Contractor shall not be responsible for such loss or defense for any copyright violations contained in the Contract Documents prepared by the Architect/Engineer or the Principal Representative of which the Contractor is unaware, or for any patent violations based on specified processes that the Contractor is unaware are patented or that the Contractor should not have had reason to believe were patented.

ARTICLE 29. ASSIGNMENT
Except as otherwise provided hereafter the Contractor shall not assign the whole or any part of this Contract without the written consent of the Principal Representative. This provision shall not be construed to prohibit assignments of the right to payment to the extent permitted by Section 4-9-406, C.R.S., as amended, provided that written Notice of assignment adequate to identify the rights assigned is received by the Principal Representative and the controller for the agency, department, or institution executing this Contract (as distinguished from the State Controller). Such assignment of the right to payment shall not be deemed valid until receipt by the Principal Representative and such controller and the Contractor assumes the risk that such written Notice of assignment is received by the Principal Representative and the controller for the agency, department, or institution involved. In case the Contractor assigns all or part of any moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the Contractor shall be subject to all claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the work called for in this Contract, whether said service or materials were supplied prior to or after the assignment. Nothing in this Article shall be deemed a waiver of any other defenses available to the State against the Contractor or the assignee.
ARTICLE 30.  CORRECTION OF WORK BEFORE ACCEPTANCE

The Contractor shall promptly remove from the premises all work or materials condemned or declared irreparably defective as failing to conform to the Contract Documents on receipt of written Notice from the Architect/Engineer or the Principal Representative, whether incorporated in the Work or not. If such materials shall have been incorporated in the Work, or if any unsatisfactory work is discovered, the Contractor shall promptly replace and re-execute his or her work in accordance with the requirements of the Contract Documents without expense to the Principal Representative, and shall also bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement of such defective material or work.

If the Contractor does not remove such condemned or irreparably defective work or material within a reasonable time, the Principal Representative may, after giving a second seven (7) day advance Notice to the Contractor and the Surety, remove them and may store the material at the Contractor's expense. The Principal Representative may accomplish the removal and replacement with its own forces or with another Contractor. If the Contractor does not pay the expense of such removal and pay all storage charges within ten (10) days thereafter, the Principal Representative may, upon ten (10) days' written Notice, sell such material at auction or at private sale and account for the net proceeds thereof, after deducting all costs and expenses which should have been borne by the Contractor. If the Contractor shall commence and diligently pursue such removal and replacement before the expiration of the seven day period, or if the Contractor shall show good cause in conjunction with submittal of a revised CPM schedule showing when the work will be performed and why such removal of condemned work should be scheduled for a later date, the Principal Representative shall not proceed to remove or replace the condemned work.

Should any defective work or material be discovered during the process of construction, or should reasonable doubt arise as to whether certain material or work is in accordance with the Contract Documents, the value of such defective or questionable material or work shall not be included in any application for payment, or if previously included, shall be deducted by the Architect/Engineer from the next application submitted by the Contractor.

If the Contractor does not perform repair, correction and replacement of defective work, in lieu of proceeding by issuance of a Notice of intent to remove condemned work as outlined above, the Principal Representative may, not less than seven (7) days after giving the original written Notice of the need to repair, correct, or replace defective work, deduct all costs and expenses of replacement or correction as instructed by the Architect/Engineer from the Contractor’s next application for payment in addition to the value of the defective work or material. The Principal Representative may also make an equitable deduction from the Contract sum by unilateral Change Order, in accordance with Article 33, Payments Withheld and Article 35, Changes In The Work.

If the Contractor disagrees with the Notice to remove work or materials condemned or declared irreparably defective, the Contractor may request facilitated negotiation of the issue and the Principal Representative’s right to proceed with removal and to deduct costs and expenses of repair shall be suspended and tolled until such time as the parties meet and negotiate the issue.

During construction, whenever the Architect/Engineer has advised the Contractor in writing, in the Specifications, by reference to Article 6, Architect/Engineer Decisions And Judgments, of these General Conditions or elsewhere in the Contract Documents of a need to observe materials in place prior to their being permanently covered up, it shall be the Contractor’s responsibility to notify the Architect/Engineer at least forty-eight (48) hours in advance of such covering operation. If the Contractor fails to provide such notification, Contractor shall, at his or her expense, uncover such portions of the work as required by the Architect/Engineer for observation, and reinstall such covering after observation. When a covering operation is continued from day to day, notification of the commencement of a single continuing covering operation shall suffice for the activity specified so long as it proceeds regularly and without interruption from day to day, in which event the Contractor shall coordinate with the Architect/Engineer regarding the continuing covering operation.
ARTICLE 31. APPLICATIONS FOR PAYMENTS

A. CONTRACTOR’S SUBMITTALS
On or before the first day of each month and no more than five days prior thereto, the Contractor may submit applications for payment for the work performed during such month covering the portion of the Work completed as of the date indicated, and payments on account of this Contract shall be due within thirty (30) days after the last day of the period for which payment is requested. The Contractor shall submit the application for payment to the Architect/Engineer on State forms SBP-7.2, Certificate for Contractor’s Payment, or such other format as the State Buildings Programs shall approve, in an itemized format in accordance with the schedule of values or a cost loaded CPM when required, supported to the extent reasonably required by the Architect/Engineer or the Principal Representative by receipts or other vouchers, showing payments for materials and labor, prior payments and payments to be made to Subcontractors and such other evidence of the Contractor’s right to payments as the Architect/Engineer or Principal Representative may direct.

If payments are made on account of materials not incorporated in the Work but delivered and suitably stored at the site, or at some other location agreed upon in writing, such payments shall be conditioned upon submission by the Contractor of bills of sale or such other procedure as will establish the Principal Representative’s title to such material or otherwise adequately protect the Principal Representative’s interests, and shall provide proof of insurance whenever requested by the Principal Representative or the Architect/Engineer, and shall be subject to the right to inspect the materials at the request of either the Architect/Engineer or the Principal Representative.

All applications for payment, except the final application, and the payments there under, shall be subject to correction in the next application rendered following the discovery of any error.

B. ARCHITECT/ENGINEER CERTIFICATION
In accordance with the Architect/Engineer’s agreement with the Principal Representative, the Architect/Engineer after appropriate observation of the progress of the work shall certify to the Principal Representative the amount that the Contractor is entitled to, and forward the application to the Principal Representative. If the Architect/Engineer certifies an amount different from the amount requested or otherwise alters the Contractor’s application for payment, a copy shall be forwarded to the Contractor.

If the Architect/Engineer is unable to certify all or portions of the amount requested due to the absence or lack of required supporting evidence, the Architect/Engineer shall advise the Contractor of the deficiency. If the deficiency is not corrected at the end of ten (10) days, the Architect/Engineer may either certify the remaining amounts properly supported to which the Contractor is entitled, or return the application for payment to the Contractor for revision with a written explanation as to why it could not be certified.

C. RETAINAGE WITHHELD
Unless otherwise provided in the Supplementary General Conditions, an amount equivalent to ten percent (10%) of the amount shown to be due the Contractor on each application for payment shall be withheld until fifty percent (50%) of the work required by the Contract has been performed. Thereafter, the remaining Certificates for Contractor’s Payment (SBP-7.2) shall be paid without retaining additional funds, if in the opinion of the Architect/Engineer and the Principal Representative, satisfactory progress is being made in the Work. The withheld percentage of the contract price of any such work, improvement, or construction shall be administered according to § 24-91-101, et seq., C.R.S., as amended, and except as provided in § 24-91-103, C.R.S., as amended, and Article 31D, shall be retained until the Work or discrete portions of the Work, have been completed satisfactorily, finally or partially accepted, and advertised for final settlement as further provided in Article 41.

D. RELEASE OF RETAINAGE
The Contractor may, for satisfactory and substantial reasons shown to the Principal Representative’s satisfaction, make a written request to the Principal Representative and the Architect/Engineer for release of part or all of the withheld percentage applicable to the work of a Subcontractor which has
completed the subcontracted work in a manner finally acceptable to the Architect/Engineer, the Contractor, and the Principal Representative. Any such request shall be supported by a written approval from the Surety furnishing the Contractor's bonds and any surety that has provided a bond for the Subcontractor. The release of any such withheld percentage shall be further supported by such other evidence as the Architect/Engineer or the Principal Representative may require, including but not limited to, evidence of prior payments made to the Subcontractor, copies of the Subcontractor's contract with the Contractor, any applicable warranties, as-built information, maintenance manuals and other customary close-out documentation. Neither the Principal Representative nor the architect Engineer shall be obligated to review such documentation nor shall they be deemed to assume any obligations to third parties by any review undertaken.

The Contractor's obligation under these General Conditions to guarantee work for one year from the date of the Notice of Substantial Completion or the date of any Notice of Partial Substantial Completion of the applicable portion or phase of the Project, shall be unaffected by such partial release; unless a Notice of Partial Substantial Completion is issued for the work subject to the release of retainage.

Any rights of the Principal Representative which might be terminated by or from the date of any final acceptance of the Work, whether at common law or by the terms of this Contract, shall not be affected by such partial release of retainage prior to any final acceptance of the entire Project.

The Contractor remains fully responsible for the Subcontractor's work and assumes any risk that might arise by virtue of the partial release to the Subcontractor of the withheld percentage, including the risk that the Subcontractor may not have fully paid for all materials, labor and equipment furnished to the Project.

If the Principal Representative considers the Contractor's request for such release satisfactory and supported by substantial reasons, the Architect/Engineer shall make a “final inspection” of the applicable portion of the Project to determine whether the Subcontractor's work has been completed in accordance with the Contract Documents. A final punch list shall be made for the Subcontractor's work and the procedures of Article 41, Completion, Final Inspection, Acceptance and Settlement, shall be followed for that portion of the work, except that advertisement of the intent to make final payment to the Subcontractor shall be required only if the Principal Representative has reason to believe that a supplier or Subcontractor to the Subcontractor for which the request is made, may not have been fully paid for all labor and materials furnished to the Project.

ARTICLE 32. CERTIFICATES FOR PAYMENTS
State Form SBP-7.2, Certificate For Contractor's Payment, and its continuation detail sheets, when submitted, shall constitute the Certificate of Contractor's Application for Payment, and shall be a representation by the Contractor to the Principal Representative that the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and materials for which payment is requested have been incorporated into the Project except as noted in the application. If requested by the Principal Representative the Certificate of Contractor's Application for Payment shall be sworn under oath and notarized.

ARTICLE 33. PAYMENTS WITHHELD
The Architect/Engineer, the Principal Representative or State Buildings Programs may withhold, or on account of subsequently discovered evidence nullify, the whole or any part of any application on account of, but not limited to any of the following:

1. Defective work not remedied;
2. Claims filed or reasonable evidence indicating probable filing of claims;
3. Failure of the Contractor to make payments to Subcontractors for material or labor;
4. A reasonable doubt that the Contract can be completed for the balance of the contract price then unpaid;
5. Damage or injury to another contractor or any other person, persons or property except to the extent of coverage by a policy of insurance;
6. Failure to obtain necessary permits or licenses or to comply with applicable laws, ordinances, codes, rules or regulations or the directions of the Architect/Engineer;
7. Failure to submit a monthly construction schedule;
8. Failure of the Contractor to keep work progressing in accordance with the time schedule;
9. Failure to keep a superintendent on the work;
10. Failure to maintain as built drawings of the work in progress;
11. Unauthorized deviations by the Contractor from the Contract Documents; or
12. On account of liquidated damages.

In addition, the Architect Engineer, Principal Representative or State Buildings Programs may withhold or nullify the whole or any part of any application for any reason noted elsewhere in these General Conditions of the Contract. Nullification shall mean reduction of amounts shown as previously paid on the application. The amount withheld or nullified may be in such amount as the Architect/Engineer or the Principal Representative estimates to be required to allow the State to accomplish the Work, cure the failure and cover any damages or injuries, including an allowance for attorneys fees and costs where appropriate. When the grounds for such withholding or nullifying are removed, payment shall be made for the amounts thus withheld or nullified on such grounds.

ARTICLE 34. DEDUCTIONS FOR UNCORRECTED WORK
If the Architect/Engineer and the Principal Representative deem it inexpedient to correct work injured or not performed in accordance with the Contract Documents, the Principal Representative may, after consultation with the Architect/Engineer and ten (10) days’ Notice to the Contractor of intent to do so, make reasonable reductions from the amounts otherwise due the Contractor on the next application for payment. Notice shall specify the amount or terms of any contemplated reduction. The Contractor may during this period elect to correct or perform the work. If the Contractor does not elect to correct or perform the work, an equitable deduction from the Contract sum shall be made by Change Order, in accordance with Article 35, Changes In The Work, unilaterally if necessary. If either party elects facilitation of this issue after Notice is given, the ten-day notice period shall be extended and tolled until facilitation has occurred.

ARTICLE 35. CHANGES IN THE WORK
The Principal Representative, or such other Procurement Officer as the Principal Representative may designate, without invalidating the Agreement, and with the approval of State Buildings Programs and the State Controller, may order extra work or make changes with or without the consent of the Contractor as hereafter provided, by altering, adding to or deducting from the Work, the Contract sum being adjusted accordingly. All such changes in the Work shall be within the general scope of and be executed under the conditions of the Contract, except that any claim for extension of time made necessary due to the change or any claim of other delay or other impacts caused by or resulting from the change in the Work shall be presented by the Contractor and adjusted by Change Order to the extent known at the time such change is ordered and before proceeding with the extra or changed work. Any claims for extension of time or of delay or other impacts, and any costs associated with extension of time, delay or other impacts, which are not presented before proceeding with the change in the Work, and which are not adjusted by Change Order to the extent known, shall be waived.

The Architect/Engineer shall have authority to make minor changes in the Work, not involving extra cost, and not inconsistent with the intent of the Contract Documents, but otherwise, except in an emergency endangering life or property, no extra work or change in the Contract Documents shall be made unless by 1) a written Change Order, approved by the Principal Representative, State Buildings Programs, and the State Controller prior to proceeding with the changed work; or 2) by an Emergency Field Change Order approved by the Principal Representative and State Buildings Programs as hereafter provided in Article 35C, Emergency Field Ordered Changed Work; or 3) by an allocation in writing of any allowance already provided in the encumbered contract amount, the Contract sum being later adjusted to decrease the Contract sum by any unallocated or unexpended amounts remaining in such allowance. No change to the Contract sum shall be valid unless so ordered.
A. THE VALUE OF CHANGED WORK
1. The value of any extra work or changes in the Work shall be determined by agreement in one or more of the following ways:
   a. By estimate and acceptance of a lump-sum amount;
   b. By unit prices specified in the Agreement, or subsequently agreed upon, that are extended by specific quantities;
   c. By actual cost plus a fixed fee in a lump sum amount for profit, overhead and all indirect and off-site home office costs, the latter amount agreed upon in writing prior to starting the extra or changed work.

2. Where the Contractor and the Principal Representative cannot agree on the value of extra work, the Principal Representative may order the Contractor to perform the changes in the Work and a Change Order may be unilaterally issued based on an estimate of the change in the Work prepared by the Architect/Engineer. The value of the change in the Work shall be the Principal Representative’s determination of the amount of equitable adjustment attributable to the extra work or change. The Principal Representative’s determination shall be subject to appeal by the Contractor pursuant to the claims process in Article 36, Claims. The Principal Representative is the Procurement Officer for purposes of all of the remedies provisions of the Contract.

3. Except as otherwise provided in Article 35B, Detailed Breakdown, below, the Cost Principles of the Colorado Procurement Rules in effect on the date of this Contract, pursuant to § 24-107-101, C.R.S., as amended, shall govern all Contract changes.

B. DETAILED BREAKDOWN
In all cases where the value of the extra or changed work is not known based on unit prices in the Contractor’s bid or the Agreement, a detailed change proposal shall be submitted by the Contractor on a Change Order Proposal (SC-6.312), or in such other format as the State Buildings Program approves, with which the Principal Representative may require an itemized list of materials, equipment and labor, indicating quantities, time and cost for completion of the changed work.

Such detailed change proposals shall be stated in lump sum amounts and shall be supported by a separate breakdown, which shall include estimates of all or part of the following when requested by the Architect/Engineer or the Principal Representative:

1. Materials, indicating quantities and unit prices including taxes and delivery costs if any (separated where appropriate into general, mechanical and electrical and/or other Subcontractors’ work; and the Principal Representative may require in its discretion any significant subcontract costs to be similarly and separately broken down).
2. Labor costs, indicating hourly rates and time and labor burden to include Social Security and other payroll taxes such as unemployment, benefits and other customary burdens.
3. Costs of project management time and superintendence time of personnel stationed at the site, and other field supervision time, but only where a time extension, other than a weather delay, is approved as part of the Change Order, and only where such project management time and superintendence time is directly attributable to and required by the change; provided however that additional cost of on-site superintendence shall be allowable whenever in the opinion of the Architect/Engineer the impact of multiple change requests to be concurrently performed will result in inadequate levels of supervision to assure a proper result unless additional superintendence is provided.
4. Construction equipment (including small tools). Expenses for equipment and fuel shall be based on customary commercially reasonable rental rates and schedules. Equipment and hand tool costs shall not include the cost of items customarily owned by workers.
5. Workers’ compensation costs, if not included in labor burden.
6. The cost of commercial general liability and property damage insurance premiums but only to the extent charged the Contractor as a result of the changed work.
7. Overhead and profit, as hereafter specified.
8. Builder’s risk insurance premium costs.
9. Bond premium costs.
10. Testing costs not otherwise excluded by these General Conditions.
11. Subcontract costs.

Unless modified in the Supplementary General Conditions, overhead and profit shall not exceed the percentages set forth in the table below.

<table>
<thead>
<tr>
<th></th>
<th>OVERHEAD</th>
<th>PROFIT</th>
<th>COMMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>To the Contractor or to Subcontractors for the portion of work performed with their own forces:</td>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>To the Contractor or to Subcontractors for work performed by others at a tier immediately below either of them:</td>
<td>5%</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

Overhead shall include: a) insurance premium for policies not purchased for the Project and itemized above, b) home office costs for office management, administrative and supervisory personnel and assistants, c) estimating and change order preparation costs, d) incidental job burdens, e) legal costs, f) data processing costs, g) interest costs on capital, h) general office expenses except those attributable to increased rental expenses for temporary facilities, and all other indirect costs, but shall not include the Social Security tax and other direct labor burdens. The term “work” as used in the proceeding table shall include labor, materials and equipment and the “Commission” shall include all costs and profit for carrying the subcontracted work at the tiers below except direct costs as listed in items 1 through 11 above if any.

On proposals for work involving both additions and credits in the amount of the Contract sum, the overhead and profit will be allowed on the net increase only. On proposals resulting in a net deduct to the amount of the Contract sum, profit on the deducted amount shall be returned to the Principal Representative at fifty percent (50%) of the rate specified. The inadequacy of the profit specified shall not be a basis for refusal to submit a proposal.

Except in the case of Change Orders or Emergency Field Change Orders agreed to on the basis of a lump sum amount or unit prices as described in paragraphs 35A1 and 35A2 above, The Value of Changed Work, the Contractor shall keep and present a correct and fully auditable account of the several items of cost, together with vouchers, receipts, time cards and other proof of costs incurred, summarized on a Change Order form (SC-6.31) using such format for supporting documentation as the Principal Representative and State Buildings Programs approve. This requirement applies equally to work done by Subcontractors. Only auditable costs shall be reimbursable on Change Orders where the value is determined on the basis of actual cost plus a fixed fee pursuant to paragraph 35A3 above, or where unilaterally determined by the Principal Representative on the basis of an equitable adjustment in accordance with the Procurement Rules, as described above in Article 35A, The Value Of Changed Work.

Except for proposals for work involving both additions and credits, changed work shall be adjusted and considered separately for work either added or omitted. The amount of adjustment for work omitted shall be estimated at the time it is directed to be omitted, and when reasonable to do so, the agreed adjustment shall be reflected on the schedule of values used for the next Contractor’s application for payment.

The Principal Representative reserves the right to contract with any person or firm other than the Contractor for any or all extra work; however, unless specifically required in the Contract Documents, the Contractor shall have no responsibility without additional compensation to supervise or coordinate the work of persons or firms separately contracted by the Principal Representative.
C. **EMERGENCY FIELD CHANGE ORDERED WORK**

The Principal Representative, without invalidating the Agreement, and with the approval of State Buildings Programs and without the approval of the State Controller, may order extra work or make changes in the case of an emergency that is a threat to life or property or where the likelihood of delays in processing a normal Change Order will result in substantial delays and or significant cost increases for the Project. Emergency Field Orders are not to be used solely to expedite normal Change Order processing absent a clear showing of a high potential for significant and substantial cost or delay. Such changes in the Work may be directed through issuance of an Emergency Field Change Order signed by the Contractor, the Principal Representative (or by a designee specifically appointed to do so in writing), and approved by the Director of State Buildings Program or his or her delegate. The change shall be directed using an Emergency Field Change Order form (SC-6.31E).

If the amount of the adjustment of the Contract price and time for completion can be determined at the time of issuance of the Emergency Field Change Order, those adjustments shall be reflected on the face of the Emergency Field Change Order. Otherwise, the Emergency Field Change Order shall reflect a not to exceed (NTE) amount for any schedule adjustment (increasing or decreasing the time for completion) and an NTE amount for any adjustment to Contract sum, which NTE amount shall represent the maximum amount of adjustment to which the Contractor will be entitled, including direct and indirect costs of changed work, as well as any direct or indirect costs attributable to delays, inefficiencies or other impacts arising out of the change. Emergency Field Change Orders directed in accordance with this provision need not bear the approval signatures of the State Controller.

On Emergency Field Change Orders where the price and schedule have not been finally determined, the Contractor shall submit final costs for adjustment as soon as practicable. No later than seven (7) days after issuance, except as otherwise permitted, and every seven days thereafter, the Contractor shall report all costs to the Principal Representative and the Architect/Engineer. Weekly cost reports and the final adjustment of the Emergency Field Change Orders amount and the adjustment to the Project time for completion shall be prepared in accordance with the procedures described in Article 35A, The Value of Changed Work, and B, Detailed Breakdown, above. Unless otherwise provided in writing signed by the Director of State Buildings Programs to the Principal Representative and the Contractor, describing the extent and limits of any greater authority, individual Emergency Field Change Orders shall not be issued for more than $25,000, nor shall the cumulative value of Emergency Field Change Orders exceed an amount of $100,000.

D. **APPROPRIATION LIMITATIONS - § 24-91-103.6, C.R.S., as amended**

The amount of money appropriated, as shown on the Agreement (SC 6.21), is equal to or in excess of the Contract amount. No Change Order, Emergency Field Change Order, or other type of order or directive shall be issued by the Principal Representative, or any agent acting on his or her behalf, which directs additional compensable work to be performed, which work causes the aggregate amount payable under the Contract to exceed the amount appropriated for the original Contract, as shown on the Agreement (SC-6.13), unless one of the following occurs: (1) the Contractor is provided written assurance from the Principal Representative that sufficient additional lawful appropriations exist to cover the cost of the additional work; or (2) the work is covered by a contractor remedy provision under the Contract, such as a claim for extra cost. By way of example only, no assurance is required for any order, directive or instruction by the Architect/Engineer or the Principal Representative to perform work which is determined to be within the performance required by the Contract Documents; the Contractor’s remedy shall be as described elsewhere in these General Conditions.

Written assurance shall be in the form of an Amendment to the Contract reciting the source and amount of such appropriation available for the Project. No remedy granting provision of this Contract shall obligate the Principal Representative to seek appropriations to cover costs in excess of the amounts recited as available to pay for the work to be performed.
ARTICLE 36. CLAIMS

It is the intent of these General Conditions to provide procedures for speedy and timely resolution of disagreements and disputes at the lowest level possible. In the spirit of on job resolution of job site issues, the parties are encouraged to use the partnering processes of Article 2D, Partnering, Communications and Cooperation, before turning to the more formal claims processes described in this Article 36, Claims. The use of non-binding dispute resolution, whether through the formal processes described in Article 39, Non-Binding Dispute Resolution – Facilitated Negotiations, or through less formal alternative processes developed as part of a partnering plan, are also encouraged. Where such process cannot resolve the issues in dispute, the claims process that follows is intended to cause the issues to be presented, decided and where necessary, documented in close proximity to the events from which the issues arise. To that end, and in summary of the remedy granting process that follows commencing with the next paragraph of this Article 36, Claims, the Contractor shall 1) first, seek a decision by the Architect/Engineer, and 2) shall second, informally present the claim to Principal Representative as described hereafter, and 3) failing resolution in the field, give Notice of intent to exercise statutory rights of review of a formal contract controversy, and 4) seek resolution outside the Contract as provided by the Procurement Code.

If the Contractor claims that any instructions, by detailed drawings, or otherwise, or any other act or omission of the Architect/Engineer or Principal Representative affecting the scope of the Contractor’s work, involve extra cost, extra time or changes in the scope of the Work under this Contract, the Contractor shall have the right to assert a claim for such costs or time, provided that before either proceeding to execute such work (except in an emergency endangering life or property), or filing a Notice of claim, the Contractor shall have obtained or requested a written decision of the Architect/Engineer following the procedures as provided in Article 6A and B, Architect/Engineer Decisions and Judgments, respectively; provided, however, that in the case of a directed change in the Work pursuant to Article 36A4, no written judgment or decision of the Architect/Engineer is required. If the Contractor is delayed by the lack of a response to a request for a decision by the Architect/Engineer, the Contractor shall give Notice in accordance with Article 38, Delays And Extensions Of Time.

Unless it is the Architect/Engineer’s judgment and determination that the work is not included in the performance required by the Contract Documents, the Contractor shall proceed with the work as originally directed. Where the Contractor’s claim involves a dispute concerning the value of work unilaterally directed pursuant to Article 35A4 the Contractor shall also proceed with the work as originally directed while his or her claim is being considered.

The Contractor shall give the Principal Representative and the Architect/Engineer Notice of any claim promptly after the receipt of the Architect/Engineer’s decision, but in no case later than three (3) business days after receipt of the Architect/Engineer’s decision (or no later than ten (10) days from the date of the Contractor’s request for a decision when the Architect/Engineer fails to decide as provided in Article 6). The Notice of claim shall state the grounds for the claim and the amount of the claim to the extent known in accordance with the procedures of Article 35, Changes In The Work. The period in which Notice must be given may be extended by the Principal Representative if requested in writing by the Contractor with good cause shown, but any such extension to be effective shall be in writing.

The Principal Representative shall respond in writing, with a copy to the Architect/Engineer, within a reasonable time, and except where a request for facilitation of negotiation has been made as hereafter provided, in no case later than seven (7) business days (or at such other time as the Contractor and Principal Representative agree) after receipt of the Contractor’s Notice of claim regarding such instructions or alleged act or omission. If no response to the Contractor’s claim is received within seven (7) business days of Contractor’s Notice (or at such other time as the Contractor and Principal Representative agree) and the instructions have not been retracted, it shall be deemed that the Principal Representative has denied the claim.

The Principal Representative may grant or deny the claim in whole or in part, and a Change Order shall be issued if the claim is granted. To the extent any portion of claim is granted where costs are not clearly shown, the Principal Representative may direct that the value of that portion of the work be determined by
any method allowed in Article 35A, The Value Of Changed Work. Except in the case of a deemed denial, the Principal Representative shall provide a written explanation regarding any portion of the Contractor's claim that is denied.

If the Contractor disagrees with the Principal Representative’s judgment and determination on the claim and seeks an equitable adjustment of the Contract sum or time for performance, he or she shall give Notice of intent to exercise his or her statutory right to seek a decision on the contract controversy within ten (10) days of receipt of the Principal Representative’s decision denying the claim. A “contract controversy,” as such term is used in the Colorado Procurement Code, § 24-109-106, C.R.S., shall not arise until the initial claim process described above in this Article 36 has been properly exhausted by the Contractor. The Contractor’s failure to proceed with work directed by the Architect/Engineer or to exhaust the claim process provided above in this Article 36, shall constitute an abandonment of the claim by the Contractor and a waiver of the right to contest the decision in any forum.

At the time of filing the Notice of intent to exercise his or her statutory right to seek a decision on the contract controversy, the Contractor may request that the Principal Representative defer a decision on the contract controversy until a later date or until the end of the Project. If the Principal Representative agrees, he or she shall so advise the Contractor in writing. If no such request is made, or if the Principal Representative does not agree to such a request, the Principal Representative shall render a written decision within twenty (20) business days and advise the Contractor of the reasons for any denial. Unless the claim has been decided by the Principal Representative (as opposed to delegates of the Principal Representative), the person who renders the decision on this statutory contract controversy shall not be the same person who decided the claim. To the extent any portion of the contract controversy is granted where costs are not clearly shown, the Principal Representative may direct that the value of that portion of the work be determined by any method allowed in Article 35A, The Value Of Changed Work. In the event of a denial the Principal Representative shall give Notice to the Contractor of his or her right to administrative and judicial reviews as provided in the Colorado Procurement Code, § 24-109-201 et seq, C.R.S., as amended. If no decision regarding the contract controversy is issued within twenty (20) business days of the Contractor's giving Notice (or such other date as the Contractor and Principal Representative have agreed), and the instructions have not been retracted or the alleged act or omission have not been corrected, it shall be deemed that the Principal Representative has ruled by denial on the contract controversy. Except in the case of a deemed denial, the Principal Representative shall provide an explanation regarding any portion of the contract controversy that involves denial of the Contractor's claim.

Either the Contractor or the Principal Representative may request facilitation of negotiations concerning the claim or the contract controversy, and if requested, the parties shall consult and negotiate before the Principal Representative decides the issue. Any request for facilitation by the Contractor shall be made at the time of the giving of Notice of the claim or Notice of the contract controversy. Facilitation shall extend the time for the Principal Representative to respond by commencing the applicable period at the completion of the facilitated negotiation, which shall be the last day of the parties’ meeting, unless otherwise agreed in writing.

Disagreement with the decision of the Architect Engineer, or the decision of the Principal Representative to deny any claim or denying the contract controversy, shall not be grounds for the Contractor to refuse to perform the work directed or to suspend or terminate performance. During the period that any claim or contract controversy decision is pending under this Article 36, Claims, the Contractor shall proceed diligently with the work directed.

In all cases where the Contractor proceeds with the work and seeks equitable adjustment by filing a claim and or statutory appeal, the Contractor shall keep a correct account of the extra cost, in accordance with Article 35B, Detailed Breakdown supported by receipts. The Principal Representative shall be entitled to reject any claim or contract controversy whenever the foregoing procedures are not followed and such accounts and receipts are not presented.

The payments to the Contractor in respect of such extra costs shall be limited to reimbursement for the current additional expenditure by the Contractor made necessary by the change in the work, plus a
reasonable amount for overhead and profit, determined in accordance with Article 35B, Detailed Breakdown, determined solely with reference to the additional work, if any, required by the change.

ARTICLE 37. DIFFERING SITE CONDITIONS

A. NOTICE IN WRITING

The Contractor shall promptly, and where possible before conditions are disturbed, give the Architect/Engineer and the Principal Representative Notice in writing of:

1. subsurface or latent physical conditions at the site differing materially from those indicated in or reasonably assumed from the information provided in the Contract Documents; and,

2. unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

The Architect/Engineer shall promptly investigate the conditions, and if it is found that such conditions do materially so differ and cause an increase or decrease in the Contractor’s costs of performance of any part of the work required by the Contract Documents, whether or not such work is changed as a result of such conditions, an equitable adjustment shall be made and the Contract sum shall be modified in accordance with Article 35, Changes In The Work.

If the time required for completion of the work affected by such materially differing conditions will extend the work on the critical path as indicated on the CPM schedule, the time for completion shall also be equitably adjusted.

B. LIMITATIONS

No claim of the Contractor under this clause shall be allowed unless the Contractor has given the Notice required in Article 37A, Notice In Writing, above. The time prescribed for presentation and adjustment in Articles 36, Claims and 38, Delays And Extensions Of Time, shall be reasonably extended by the State to the extent required by the nature of the differing conditions; provided, however, that even when so extended no claim by the Contractor for an equitable adjustment hereunder shall be allowed if not quantified and presented prior to the date the Contractor requests a final inspection pursuant to Article 41A, Notice Of Completion.

ARTICLE 38. DELAYS AND EXTENSIONS OF TIME

If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the State of Colorado or the Architect/Engineer, or of any employee or agent of either, or by any separately employed Contractor or by strikes, lockouts, fire, unusual delay in transportation, unavoidable casualties or any other causes beyond the Contractor’s control, including weather delays as defined below, the time of Completion of the Work shall be extended for a period equal to such portion of the period of delays directly affecting the completion of the Work as the Contractor shall be able to show he or she could not have avoided by the exercise of due diligence.

The Contractor shall provide Notice in writing to the Architect/Engineer, the Principal Representative and State Buildings Programs within three (3) business days from the beginning of such delay and shall file a written claim for an extension of time within seven (7) business days after the period of such delay has ceased, otherwise, any claim for an extension of time is waived.

Provided that the Contractor has submitted reasonable schedules for approval when required by Article 12, Requests for Information and Schedules, if no schedule is agreed to fixing the dates on which the responses to requests for information or detail drawings will be needed, or Shop Drawings, Product Data or Samples are to be reviewed as required or allowed by Article 12B, Schedules, no extension of time will be allowed for the Architect/Engineer’s failure to furnish such detail drawings as needed, or for the failure to initially review Shop Drawings, Product Data or Samples, except in respect of that part of any delay in furnishing detail drawings or instructions extending beyond a reasonable period after written demand for such detailed drawings or instructions is received by the Architect/Engineer. In any event, any claim for an extension of time for such cause will be recognized only to the extent of delay directly caused by failure to furnish detail
drawings or instructions or to review Shop Drawings, Product Data or Samples pursuant to schedule, after such demand.

All claims for extension of time due to a delay claimed to arise or result from ordered changes in the scope of the Work, or due to instructions claimed to increase the scope of the Work, shall be presented to the Architect/Engineer, the Principal Representative and State Buildings Programs as part of a claim for extra cost, if any, in accordance with Article 36, Claims, and in accordance with the Change Order procedures required by Article 35, Changes In The Work.

Except as otherwise provided in this paragraph, no extension of time shall be granted when the Contractor has failed to utilize a CPM schedule or otherwise identify the Project’s critical path as specified in Article 12, Requests for Information and Schedules, or has elected not to do so when allowed by the Supplementary General Conditions or the Specifications to use less sophisticated scheduling tools, or has failed to maintain such a schedule. Delay directly affecting the completion of the Work shall result in an extension of time only to the extent that completion of the Work was affected by impacts to the critical path shown on Contractor’s CPM schedule. Where the circumstances make it indisputable in the opinion of the Architect/Engineer that the delay affected the completion of the Work so directly that the additional notice of the schedule impact by reference to a CPM schedule was unnecessary, a reasonable extension of time may be granted.

Extension of the time for completion of the Work will be granted for delays due to weather conditions only when the Contractor demonstrates that such conditions were more severe and extended than those reflected by the ten-year average for the month, as evidenced by the Climatological Data, U. S. Department of Commerce, for the Project area.

Extensions of the time for completion of the Work due to weather will be granted on the basis of one and three tenths (1.3) calendar days for every day that the Contractor would have worked but was unable to work, with each separate extension figured to the nearest whole calendar day.

For weather delays and delays caused by events, acts or omissions not within the control of the Principal Representative or any person acting on the Principal Representative’s behalf, the Contractor shall be entitled to an extension of time only and shall not be entitled to recovery of additional cost due to or resulting from such delays. This Article does not, however, preclude the recovery of damages for delay by either party under other provisions in the Contract Documents.

ARTICLE 39. NON-BINDING DISPUTE RESOLUTION – FACILITATED NEGOTIATIONS

The Contractor and Principal Representative agree to designate one or more mutually acceptable persons willing and able to facilitate negotiations and communications for the resolution of conflicts, disagreements or disputes between them at the specific request of either party with regard to any Project decision of either of them or any decision of the Architect/Engineer. The designation of such person(s) shall not carry any obligation to use their services except that each party agrees that if the other party requests the intervention of such person(s) with respect to any such conflict, dispute or disagreement, the non-requesting party shall participate in good faith attempts to negotiate a resolution of the issue in dispute. If the parties cannot agree on a mutually acceptable person to serve in this capacity one shall be so appointed; provided, however, that either party may request the director of State Buildings Programs to appoint such a person, who, if appointed, shall be accepted for this purpose by both the Contractor and the Principal Representative.

The cost, if any, of the facilitative services of the person(s) so designated shall be shared if the parties so agree in any partnering plan; or in the absence of agreement the cost shall be borne by the party requesting the facilitation of negotiation.

Any dispute, claim, question or disagreement arising from or relating to the Contract or an alleged breach of the Contract may be subject to a request by either party for facilitated negotiation subject to the limitations hereafter listed, and the parties shall participate by consultation and negotiation with each other, as guided by the facilitator and with recognition of their mutual interests, in an attempt to reach an equitable solution satisfactory to both parties.
The obligation to participate in facilitated negotiations shall be as described above and elsewhere in these General Conditions, as by way of example in Article 36, Claims, or Article 34, Deductions for Uncorrected Work, and to the extent not more particularly described or limited elsewhere, each party’s obligations shall be as follows:

1. a party shall not initiate communication with the facilitator regarding the issues in dispute; except that any request for facilitation shall be made in writing with copies sent, faxed or delivered to the other party;
2. a party shall prepare a brief written description of its position if so requested by the facilitator (who may elect to first discuss the parties’ positions with each party separately in the interest of time and expense);
3. a party shall respond to any reasonable request for copies of documents requested by the facilitator, but such requests, if voluminous, may consist of an offer to allow the facilitator access to the parties’ documents;
4. a party shall review any meeting agenda proposed by a facilitator and endeavor to be informed on the subjects to be discussed;
5. a party shall meet with the other party and the facilitator at a mutually acceptable place and time, or, if none can be agreed to, at the time and place designated by the facilitator for a period not to exceed four hours unless the parties agree to a longer period;
6. a party shall endeavor to assure that any facilitation meeting shall be attended by any other persons in their employ that the facilitator requests be present, if reasonably available, including the Architect/Engineer;
7. each party shall participate in such facilitated face-to-face negotiations of the issues in dispute through persons fully authorized to resolve the issue in dispute;
8. each party shall be obligated to participate in negotiations requested by the other party and to perform the specific obligations described in paragraphs (1) through (10) this Article 39, Facilitated Negotiation, no more than three times during the course of the Project;
9. neither party shall be under any obligation to resolve any issue by facilitated negotiation, but each agrees to participate in good faith and the Principal Representative shall direct the Architect/Engineer to appropriately document any resolution or agreement reached and to execute any Amendment or Change Order to the Contract necessary to implement their agreement; and,
10. any discussions and documents prepared exclusively for use in the negotiations shall be deemed to be matters pertaining to settlement negotiations and shall not be subsequently available in further proceedings except to the extent of any documented agreement.

In accordance with State Fiscal Rules and Article 52F, Choice of Law; No Arbitration, nothing in this Article 39 shall be deemed to call for arbitration or otherwise obligate the State to participate in any form of binding alternative dispute resolution.

A partnering plan developed as described in Article 2D, Communications and Cooperation, may modify or expand the requirements of this Article but may not reduce the obligation to participate in facilitated negotiations when applicable. In the case of small projects estimated to be valued under $500,000, the requirements of this Article may be deleted from this Contract, by modification in Article 54, Optional Provisions And Elections. When so modified, the references to the parties’ right to elect facilitated negotiation elsewhere in these General Conditions shall be deleted.

ARTICLE 40.  RIGHT OF OCCUPANCY

The Principal Representative shall have the right to take possession of and to use any completed or partially completed portions of the Work, even if the time for completing the entire Work or portions of the Work has not expired and even if the Work has not been finally accepted, and the Contractor shall fully cooperate with the Principal Representative to allow such possession and use. Such possession and use shall not constitute an acceptance of such portions of the Work.

Prior to any occupancy of the Project, an inspection shall be made by the Architect/Engineer, State Buildings Programs and the Contractor. Such inspection shall be made for the purpose of ensuring that the building is
secure, protected by operation safety systems as designed, operable exits, power, lighting and HVAC systems, and otherwise ready for the occupancy intended and the Notice of Substantial Completion has been issued for the occupancy intended. The inspection shall also document existing finish conditions to allow assessment of any damage by occupants. The Contractor shall assist the Principal Representative in completing and executing State Form SBP-01, Approval of Occupancy/Use, prior to the Principal Representative's possession and use. Any and all areas so occupied will be subject to a final inspection when the Contractor complies with Article 41, Completion, Final Inspection, Acceptance and Settlement.

ARTICLE 41. COMPLETION, FINAL INSPECTION, ACCEPTANCE AND SETTLEMENT

A. NOTICE OF COMPLETION
When the Work, or a discrete physical portion of the Work (as hereafter described) which the Principal Representative has agreed to accept separately, is substantially complete and ready for final inspection, the Contractor shall file a written Notice with the Architect/Engineer that the Work, or such discrete physical portion, in the opinion of the Contractor, is substantially complete under the terms of the Contract. The Contractor shall prepare and submit with such Notice a comprehensive list of items to be completed or corrected prior to final payment, which shall be subject to review and additions as the Architect/Engineer or the Principal Representative shall determine after inspection. If the Architect/Engineer or the Principal Representative believe that any of the items on the list of items submitted, or any other item of work to be corrected or completed, or the cumulative number of items of work to be corrected or completed, will prevent a determination that the Work is substantially complete, those items shall be completed by the Contractor and the Notice shall then be resubmitted.

B. FINAL INSPECTION
Within ten (10) days after the Contractor files written Notice that the Work is substantially complete, the Architect/Engineer, the Principal Representative, and the Contractor shall make a “final inspection” of the Project to determine whether the Work is substantially complete and has been completed in accordance with the Contract Documents. State Buildings Programs shall be notified of the inspection not less than three (3) business days in advance of the inspection. The Contractor shall provide the Principal Representative and the Architect/Engineer an updated punch list in sufficient detail to fully outline the following:

1. work to be completed, if any; and
2. work not in compliance with the Drawings or Specifications, if any.

A final punch list shall be made by the Architect/Engineer in sufficient detail to fully outline to the Contractor:

1. work to be completed, if any;
2. work not in compliance with the Drawings or Specifications, if any; and
3. unsatisfactory work for any reason, if any.

The required number of copies of the final punch list will be countersigned by the authorized representative of the Principal Representative and will then be transmitted by the Architect/Engineer to the Contractor, the Principal Representative, and State Buildings Programs. The Architect/Engineer's final punch list shall control over the Contractor's preliminary punch list.

C. NOTICE OF SUBSTANTIAL COMPLETION
Notice of Substantial Completion shall establish the date of substantial completion of the Project. The Contractor acknowledges and agrees that because the departments, agencies and institutions of the State of Colorado are generally involved with the business of the public at large, greater care must be taken in establishing the date of substantial completion than might otherwise be the case to ensure that a project or building or discrete physical portion of the Work is fully usable and safe for public use, and that such care necessarily raises the standard by which the concept of substantial completion is applied for a public building.
The Notice of Substantial Completion shall not be issued until the following have been fully established:

1. All required building code inspections have been called for and the appropriate code officials have affixed their signatures to the Building Inspection Record indicating successful completion of all required code inspections;

2. All required corrections noted on the Building Inspection Record shall have been completed unless the Architect/Engineer, the Principal Representative and State Buildings Programs, in their complete and absolute discretion, all concur that the condition requiring the remaining correction is not in any way life threatening, does not otherwise endanger persons or property, and does not result in any undue inconvenience or hardship to the Principal Representative or the public;

3. The building, structure or Project can be fully and comfortably used by the Principal Representative and the public without undue interference by the Contractor's employees and workers during the completion of the final punch list taking into consideration the nature of the public uses intended and taking into consideration any stage or level of completion of HVAC system commissioning or other system testing required by the Specifications to be completed prior to issuance of the Notice of Substantial Completion;

4. The Project has been fully cleaned as required by these General Conditions, and as required by any stricter requirements of the Specifications, and the overall state of completion is appropriate for presentation to the public; and

5. The Contractor has provided a schedule for the completion of each and every item identified on the punch list which specifies the Subcontractor or trade responsible for the work, and the dates the completion or correction of the item will be commenced and finished; such schedule will show completion of all remaining final punch list items within the period indicated in the Contract for final punch list completion prior to Final Acceptance, with the exception of only those items which are beyond the control of the Contractor despite due diligence. The schedule shall provide for a reasonable punch list inspection process. Unless liquidated damages have been specified in Article 54D(2), the cost to the Principal Representative, if any, for re-inspections due to failure to adhere to the Contractor's proposed punch-list completion schedule shall be the responsibility of the Contractor and may be deducted by the Principal Representative from final amounts due to the Contractor.

Substantial completion of the entire Project shall not be conclusively established by a decision by the Principal Representative to take possession and use of a portion, or all of the Project, where portions of the Project cannot meet all the criteria noted above. Notice of Substantial Completion for the entire Project shall, however, only be withheld for substantial reasons when the Principal Representative has taken possession and uses all of the Project in accordance with the terms of Article 40, Right Of Occupancy. Failure to furnish the required completion schedule shall constitute a substantial reason for withholding the issuance of any Notice of Substantial Completion.

The Contractor shall have the right to request a final inspection of any discrete physical portion of the Project when in the opinion of the Architect/Engineer a final punch list can be reasonably prepared, without confusion as to which portions of the Project are referred to in any subsequent Notice of Partial Final Settlement which might be issued after such portion is finally accepted. Discrete physical portions of the Project may be, but shall not necessarily be limited to, such portions of the Project as separate buildings where a Project consists of multiple buildings. Similarly, an addition to an existing building where the Project also calls for renovation or remodeling of the existing building may constitute a discrete physical portion of the Project. In such circumstances, when in the opinion of the Principal Representative, the Architect/Engineer and State Buildings Programs, the requirements for issuance of a Notice of Substantial Completion can be satisfied with respect to the discrete portion of the Project, a partial Notice of Substantial Completion may be issued for such discrete physical portion of the Project. The ability to beneficially occupy a discrete physical portion of the Project shall also be considered.
D. **NOTICE OF ACCEPTANCE**

The Notice of Acceptance shall establish the completion date of the Project. It shall not be authorized until the Contractor shall have performed all of the work to allow completion and approval of the Pre-Acceptance Checklist (SBP-05).

Where partial Notices of Substantial Completion have been issued, partial Notices of Final Acceptance may be similarly issued when appropriate for that portion of the Work. Partial Notice of Final Acceptance may also be issued to exclude the work described in Change Orders executed during late stages of the Project where a later completion date for the Change Ordered work is expressly provided for in the Contract as amended by the Change Order, provided the work can be adequately described to allow partial advertisement of any Notice of Partial Final Settlement to be issued without confusion as to the work included for which final payment will be made.

E. **SETTLEMENT**

Final payment and settlement shall be made on the date fixed and published for such payment except as hereafter provided. The Principal Representative shall not authorize final payment until all items on the Pre-Acceptance checklist (SBP-05) have been completed, the Notice of Acceptance issued, and the Notice of Contractors Settlement published. If the work shall be substantially completed, but Final Acceptance and completion thereof shall be prevented through delay in correction of minor defects, or unavailability of materials or other causes beyond the control of the Contractor, the Principal Representative in his or her discretion may release to the Contractor such amounts as may be in excess of three times the cost of completing the unfinished work or the cost of correcting the defective work, as estimated by the Architect/Engineer and approved by State Buildings Programs. Before the Principal Representative may issue the Notice of Contractor's Settlement and advertise the Project for final payment, the Contractor shall have corrected all items on the punch list except those items for which delayed performance is expressly permitted, subject to withholding for the cost thereof, and shall have:

1. **Delivered to the Architect/Engineer:**
   a. All guarantees and warranties;
   b. All statements to support local sales tax refunds, if any;
   c. Three (3) complete bound sets of required operating maintenance instructions; and,
   d. One (1) set of as-built Contract Documents showing all job changes.

2. **Demonstrated to the operating personnel of the Principal Representative the proper operation and maintenance of all equipment.**

Upon completion of the foregoing the Project shall be advertised in accordance with the Notice of Contractor's Settlement by two publications of Notice, the last publication appearing at least ten (10) days prior to the time of final settlement. Publication and final settlement should not be postponed or delayed solely by virtue of unresolved claims against the Project or the Contractor from Subcontractors, suppliers or materialmen based on good faith disputes; the resolution of the question of payment in such cases being directed by statute.

Except as hereafter provided, on the date of final settlement thus advertised, provided the Contractor has submitted a written Notice to the Architect/Engineer that no claims have been filed, and further provided the Principal Representative shall have received no claims, final payments and settlement shall be made in full. If any unpaid claim for labor, materials, rental machinery, tools, supplies or equipment is filed before payment in full of all sums due the Contractor, the Principal Representative and the State Controller shall withhold from the Contractor on the date established for final settlement, sufficient funds to insure the payment of such claim, until the same shall have been paid or withdrawn, such payment or withdrawal to be evidenced by filing a receipt in full or an order for withdrawal signed by the claimant or his or her duly authorized agent or assignee. The amount so withheld may be in the amount of 125% of the claims or such other amount as the Principal Representative reasonably deems necessary to cover expected legal expenses. Such withheld amounts shall be in addition to any
amount withheld based on the cost to compete unfinished work or the cost to repair defective work. However, as provided by statute, such funds shall not be withheld longer than ninety (90) days following the date fixed for final settlement with the Contractor, as set forth in the published Notice of Contractor's Settlement, unless an action at law shall be commenced within that time to enforce such unpaid claim and a Notice of such action at law shall have been filed with the Principal Representative and the State Controller. At the expiration of the ninety (90) day period, the Principal Representative shall authorize the State Controller to release to the Contractor all other money not the subject of such action at law or withheld based on the cost to compete unfinished work or the cost to repair defective work.

Notices of Partial Final Settlement may be similarly advertised, provided all conditions precedent have been satisfied as though that portion of the work affected stood alone, a Notice of Partial Acceptance has been issued, and the consent of surety to the partial final settlement has been obtained in writing. Thereafter, partial final payments may be made to the Contractor subject to the same conditions regarding unpaid claims.

ARTICLE 42. GENERAL WARRANTY AND CORRECTION OF WORK AFTER ACCEPTANCE
The Contractor warrants that the materials used and the equipment furnished shall be new and of good quality unless specified to the contrary. The Contractor further warrants that the Work shall in all respects be free from material defects not permitted by the Specifications and shall be in accordance with the requirements of the Contract Documents. Neither the final certificate for payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for defects or faulty materials or workmanship. The Contractor shall be responsible to the Principal Representative for such warranties for the longest period permitted by any applicable statute of limitations.

In addition to these general warranties, and without limitation of these general warranties, for a period of one year after the date of any Notice of Substantial Completion, or any Notice of Partial Substantial Completion if applicable, the Contractor shall remedy defects, and faulty workmanship or materials, and work not in accordance with the Contract Documents which was not accepted at the time of the Notice of Final Acceptance, all in accordance with the provisions of Article 45, One-Year Guarantee And Special Guarantees And Warranties.

ARTICLE 43. LIENS
Colorado statutes do not provide for any right of lien against public buildings. In lieu thereof, § 38-26-107, C.R.S., provides adequate relief for any claimant having furnished labor, materials, rental machinery, tools, equipment, or services toward construction of the particular public work in that final payment may not be made to a Contractor until all such creditors have been put on Notice by publication in the public press of such pending payment and given opportunity for a period of up to ninety (90) days to stop payment to the Contractor in the amount of such claims.

ARTICLE 44. ONE-YEAR GUARANTEE AND SPECIAL GUARANTEES AND WARRANTIES
A. ONE-YEAR GUARANTEE OF THE WORK
The Contractor shall guarantee to remedy defects and repair or replace the Work for a period of one year from the date of the Notice of Substantial Completion or from the dates of any partial Notices of Substantial Completion issued for discrete physical portions of the Work. The Contractor shall remedy any defects due to faulty materials or workmanship and shall pay for, repair and replace any damage to other work resulting therefrom, which shall appear within a period of one year from the date of such Notice(s) of Substantial Completion. The Contractor shall also remedy any deviation from the requirements of the Contract Documents which shall later be discovered within a period of one year from the date of the Notice of Substantial Completion; provided, however, that the Contractor shall not be required to remedy deviations from the requirements of the Contract Documents where such deviations were obvious, apparent and accepted by the Architect/Engineer or the Principal Representative at the time of the Notice of Final Acceptance. The Principal Representative shall give Notice of observed defects or other work requiring correction with reasonable promptness. Such Notice shall be in writing to the Architect/Engineer and the Contractor.
The one year guarantee of the Contractor's work may run separately for discrete physical portions of the Work for which partial Notices of Substantial Completion have been issued, however, it shall run from the last Notice of Substantial Completion with respect to all or any systems common to the work to which more than one Notice of Substantial Completion may apply.

This one-year guarantee shall not be construed to limit the Contractor's general warranty described in Article 42, General Warranty and Correction of Work After Acceptance, that all materials and equipment are new and of good quality, unless specified to the contrary, and that the Work shall in all respects be free from material defects not permitted by the Specifications and in accordance with the requirements of the Contract Documents.

**B. SPECIAL GUARANTEES AND WARRANTIES**

In case of work performed for which product, manufacturers or other special warranties are required by the Specifications, the Contractor shall secure the required warranties and deliver copies thereof to the Principal Representative through the Architect/Engineer upon completion of the work.

These product, manufacturers or other special warranties, as such, do not in any way lessen the Contractor's responsibilities under the Contract. Whenever guarantees or warranties are required by the Specifications for a longer period than one year, such longer period shall govern.

**ARTICLE 45. GUARANTEE INSPECTIONS AFTER COMPLETION**

The Architect/Engineer, the Principal Representative and the Contractor together shall make at least two (2) complete inspections of the work after the Work has been determined to be substantially complete and accepted. One such inspection, the "Six-Month Guarantee Inspection," shall be made approximately six (6) months after date of the Notice of Substantial Completion, unless in the case of smaller projects valued under $500,000 this inspection is declined in Article 54A, Modification of Article 45, in which case the inspection to occur at six months shall not be required. Another such inspection, the "Eleven-Month Guarantee Inspection" shall be made approximately eleven (11) months after the date of the Notice of Substantial Completion. The Principal Representative shall schedule and so notify all parties concerned, including State Buildings Programs, of these inspections. If more than one Notice of Substantial Completion has been issued at the reasonable discretion of the Principal Representative separate eleven month inspections may be required where the one year guarantees do not run reasonably concurrent.

Written punch lists and reports of these inspections shall be made by the Architect/Engineer and forwarded to the Contractor, the Principal Representative, State Buildings Programs, and all other participants within ten (10) days after the completion of the inspections. The punch list shall itemize all guarantee items, prior punch list items still to be corrected or completed and any other requirements of the Contract Documents to be completed which were not waived by final acceptance because they were not obvious or could not reasonably have been previously observed. The Contractor shall immediately initiate such remedial work as may be necessary to correct any deficiencies or defective work shown by this report, and shall promptly complete all such remedial work in a manner satisfactory to the Architect/Engineer, the Principal Representative and State Buildings Programs.

If the Contractor fails to promptly correct all deficiencies and defects shown by this report, the Principal Representative may do so, after giving the Contractor ten (10) days written Notice of intention to do so.

The State of Colorado, acting by and through the Principal Representative, shall be entitled to collect from the Contractor all costs and expenses incurred by it in correcting such deficiencies and defects, as well as all damages resulting from such deficiencies and defects.

**ARTICLE 46. TIME OF COMPLETION AND LIQUIDATED DAMAGES**

*It is hereby understood and mutually agreed, by and between the parties hereto, that the date of beginning, rate of progress, and the time for completion of the Work to be done hereunder are ESSENTIAL CONDITIONS of this Agreement, and it is understood and agreed that the Work embraced in this Contract shall be commenced at the time specified in the Notice to Proceed (SC-6.26).*
It is further agreed that time is of the essence of each and every portion of this Contract, and of any portion of the Work described on the Drawings or Specifications, wherein a definite and certain length of time is fixed for the performance of any act whatsoever. The parties further agree that where under the Contract additional time is allowed for the completion of the Work or any identified portion of the Work, the new time limit or limits fixed by such extension of the time for completion shall be of the essence of this Agreement.

The Contractor acknowledges that subject to any limitations in the Advertisement for Bids, issued for the Project, the Contractor’s bid is consistent with and considers the number of days to substantially complete the Project and the number of days to finally complete the Project to which the parties may have stipulated in the Agreement, which stipulation was based on the Contractor’s bid. The Contractor agrees that work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will ensure the Project will be substantially complete, and fully and finally complete, as recognized by the issuance of all required Notices of Substantial Completion and Notices of Final Acceptance, within any times stipulated and specified in the Agreement, as the same may be amended by Change Order or other written modification, and that the Principal Representative will be damaged if the times of completion are delayed.

It is expressly understood and agreed, by and between the parties hereto, that the times for the Substantial Completion of the Work or for the final acceptance of the Work as may be stipulated in the Agreement, and as applied here and in Article 54D, Modifications of Article 46, are reasonable times for these stages of completion of the Work, taking into such consideration all factors, including the average climatic range and usual industrial conditions prevailing in the locality of the building operations.

If the Contractor shall neglect, fail or refuse to complete the Work within the times specified in the Agreement, such failure shall constitute a breach of the terms of the Contract and the State of Colorado, acting by and through the Principal Representative, shall be entitled to liquidated damages for such neglect, failure or refusal, as specified in Article 54D, Modification of Article 46.

The Contractor and the Contractor’s Surety shall be jointly liable for and shall pay the Principal Representative, or the Principal Representative may withhold, the sums hereinafter stipulated as liquidated damages for each calendar day of delay beginning after the stipulated number of days for Substantial Completion from the date of the Notice to Proceed, until the date of the Notice of Substantial Completion. Unless otherwise specified in any Supplementary General Conditions, in the event of any partial Notice of Substantial Completion, liquidated damages shall accrue until all required Notices of Substantial Completion are issued.

In the first instance, specified in Article 54D(1), Modification of Article 46, liquidated damages, if any, shall be the amount specified therein, for each calendar day of delay beginning after the stipulated number of days for Substantial Completion from the date of the Notice to Proceed, until the date of the Notice of Substantial Completion. Unless otherwise specified in any Supplementary General Conditions, in the event of any partial Notice of Substantial Completion, liquidated damages shall accrue until all required Notices of Substantial Completion are issued.

In the second instance, specified in Article 54D(2), Modification of Article 46, liquidated damages, if any, shall be the amount specified in Article 54D, Modification of Article 46, for each calendar day in excess of the number of calendar days specified in the Contractor’s bid for the Project and stipulated in the Agreement to finally complete the Project (as defined by the issuance of the Notice of Acceptance) after the final Notice of Substantial Completion has been issued.

In the third instance, when so specified in both Articles 54D(1) and (2), both types of liquidated damages shall be separately assessed where those delays have occurred.

The parties expressly agree that said amounts are a reasonable estimate of the presumed actual damages that would result from any of the breaches listed, and that any liquidated damages that are assessed have been agreed to in light of the difficulty of ascertaining the actual damages that would be caused by any of these breaches at the time this Contract was formed; the liquidated damages in the first instance representing an estimate of damages due to the inability to use the Project; the liquidated damages in the
second instance representing an estimate of damages due to the additional administrative, technical, supervisory and professional expenses related to and arising from the extended closeout period including delivery of any or all guarantees and warranties, the submittals of sales and use tax payment forms, the calling for the final inspection and the completion of the final punch list.

The parties also agree and understand that the liquidated damages to be assessed in each instance are separate and distinct, although potentially cumulative, damages for the separate and distinct breaches of delayed substantial completion or final acceptance. Such liquidated damages shall not be avoided by virtue of the fact of concurrent delay caused by the Principal Representative, or anyone acting on behalf of the Principal Representative, but in such event the period of delay for which liquidated damages are assessed shall be equitably adjusted in accordance with Article 38, Delays And Extensions Of Time.

ARTICLE 47. DAMAGES
If either party to this Contract shall suffer damage under this Contract in any manner because of any wrongful act or neglect of the other party or of anyone employed by either of them, then the party suffering damage shall be reimbursed by the other party for such damage. Except to the extent of damages liquidated for the Contractor’s failure to achieve timely completion as set forth in Article 46, Time of Completion and Liquidated Damages, the Principal Representative shall be responsible for, and at his or her option may insure against, loss of use of any existing property not included in the Work, due to fire or otherwise, however caused. Notwithstanding the foregoing, or any other provision of this Contract, to the contrary, no term or condition of this contract shall be construed or interpreted as a waiver, express or implied, of any of the immunities, rights, benefits, protection, or other provisions of the Colorado Governmental Immunity Act, Section 24-10-101, et seq., CRS, as now or hereafter amended. The parties understand and agree that liability for claims for injuries to persons arising out of negligence of the State of Colorado, its departments, institutions, agencies, boards, officials and employees is controlled and limited by the provisions of Section 24-10-101, et seq., CRS, as now or hereafter amended and the risk management statutes, Section 24-30-1501, et seq., CRS, as now or hereafter amended.

Notice of intent to file a claim under this clause shall be made in writing to the party liable within a reasonable time of the first observance of such damage and not later than the time of final payment, except that in the case of claims by the Principal Representative involving warranties against faulty work or materials Notice shall be required only to the extent stipulated elsewhere in these General Conditions. Claims made to the Principal Representative involving extra cost or extra time arising by virtue of instructions to the Contractor to which Article 36, Claims, applies shall be made in accordance with Article 36. Other claims arising under the Contract involving extra cost or extra time which are made to the Principal Representative under this clause shall also be made in accordance with the procedures of Article 36, whether or not arising by virtue of instructions to the Contractor; provided however that it shall not be necessary to first obtain or request a written judgment of the Architect/Engineer.

Provided written Notice of intent to file a claim is provided as required in the preceding paragraph, nothing in this Article shall limit or restrict the rights of either party to bring an action at law or to seek other relief to which either party may be entitled, including consequential damages, if any, and shall not be construed to limit the time during which any action might be brought. Nothing in these General Conditions shall be deemed to limit the period of time during which any action may be brought as a matter of contract, tort, warranty or otherwise, it being the intent of the parties to allow any and all actions at law or in equity for such periods as the law permits. All such rights shall, however be subject to the obligation to assert claims and to appeal denials pursuant to Article 36, Claims, where applicable.

ARTICLE 48. STATE’S RIGHT TO DO THE WORK; TEMPORARY SUSPENSION OF WORK; DELAY DAMAGES
A. STATE’S RIGHT TO DO THE WORK
If after receipt of Notice to do so, the Contractor should neglect to prosecute the Work properly or fail to perform any provision of the Contract, the Principal Representative, after a second seven (7) days’ advance written Notice to the Contractor and the Surety may, without prejudice to any other remedy the Principal Representative may have, take control of all or a portion of the Work, as the Principal Representative deems necessary and make good such deficiencies deducting the cost thereof from
the payment then or thereafter due the Contractor, as provided in Article 30, Correction Of Work Before Acceptance and Article 33, Payments Withheld, provided, however, that the Architect/Engineer shall approve the amount charged to the Contractor by approval of the Change Order.

B. TEMPORARY SUSPENSION OF WORK
The State, acting for itself or by and through the Architect/Engineer, shall have the authority to suspend the Work, either wholly or in part, for such period or periods as may be deemed necessary due to:

1. Unsuitable weather;
2. Faulty workmanship;
3. Improper superintendence;
4. Contractor’s failure to carry out orders or to perform any provision of the Contract Documents;
5. Loss of, or restrictions to, appropriations;
6. Conditions, which may be considered unfavorable for the prosecution of the Work.

If it should become necessary to stop work for an indefinite period, the Contractor shall store materials in such manner that they will not become an obstruction or become damaged in any way; and he or she shall take every precaution to prevent damage to or deterioration of the Work, provide suitable drainage and erect temporary structures where necessary.

Notice of suspension of work shall be provided to the Contractor in writing stating the reasons therefore. The Contractor shall again proceed with the work when so notified in writing.

The Contractor understands and agrees that the State of Colorado cannot predict with certainty future revenues and could ultimately lack the revenue to fund the appropriations applicable to this Contract. The Contractor further acknowledges and agrees that in such event that State may, upon Notice to the Contractor, suspend the work in anticipation of a termination of the Contract for the convenience of the State, pursuant to Article 50, Termination For Convenience of State. If the Contract is not so terminated the Contract sum and the Contract time shall be equitably adjusted at the time the Principal Representative directs the work to be recommenced and gives Notice that the revenue to fund the appropriation is available.

C. DELAY DAMAGES
The Principal Representative and the State of Colorado shall be liable to the Contractor for the payment of any claim for extra costs, extra compensation or damages occasioned by hindrances or delays encountered in the work only when and to the limited extent that such hindrance or delay is caused by an act or omission within the control of the Principal Representative, the Architect/Engineer or other persons or entitles acting on behalf of the Principal Representative. Further, the Principal Representative and the State of Colorado shall be liable to the Contractor for the payment of such a claim only if the Contractor has provided required Notice of the delay or impact, or has presented its claim for an extension of time or claim of other delay or other impact due to changes ordered in the work before proceeding with the changed work. Except as otherwise provided, claims for extension of time shall be Noticed and filed in accordance with Article 38, Delays and Extensions of Time, within three (3) business days of the beginning of the delay with any claim filed within seven (7) days after the delay has ceased, or such claim is waived. Claims for extension of time or for other delay or other impact resulting from changes ordered in the Work shall be presented and adjusted as provided in Article 35, Changes in the Work.

ARTICLE 49. STATE’S RIGHTS TO TERMINATE CONTRACT
A. GENERAL
If the Contractor should be adjudged bankrupt, or if he or she should make a general assignment for the benefit of his or her creditors, or if a receiver should be appointed to take over his affairs, or if he or she should fail to prosecute his or her work with due diligence and carry the work forward in accordance with the construction schedule and the time limits set forth in the Contract Documents, or if he or she should fail to subsequently perform one or more of the provisions of the Contract Documents
to be performed by him, the Principal Representative may serve written Notice on the Contractor and the Surety on performance and payment bonds, stating his or her intention to exercise one of the remedies hereinafter set forth and the grounds upon which the Principal Representative bases his or her right to exercise such remedy.

In such event, unless the matter complained of is satisfactorily cleared within ten (10) days after delivery of such Notice, the Principal Representative may, without prejudice to any other right or remedy, exercise one of such remedies at once, having first obtained the concurrence of the Architect/Engineer in writing that sufficient cause exists to justify such action.

B. CONDITIONS AND PROCEDURES

1. The Principal Representative may terminate the services of the Contractor, which termination shall take effect immediately upon service of Notice thereof on the Contractor and his or her Surety, whereupon the Surety shall have the right to take over and perform the Contract. If the Surety does not provide Notice to the Principal Representative of its intent to commence performance of the Contract within ten (10) days after delivery of the Notice of termination, the Principal Representative may take over the Work, take possession of and use all materials, tools, equipment and appliances on the premises and prosecute the Work to completion by such means as he or she shall deem best. In the event of such termination of his or her service, the Contractor shall not be entitled to any further payment under the Contract until the Work is completed and accepted. If the Principal Representative takes over the Work and if the unpaid balance of the contract price exceeds the cost of completing the Work, including compensation for any damages or expenses incurred by the Principal Representative through the default of the Contractor, such excess shall be paid to the Contractor. If, however, the cost, expenses and damages as certified by the Architect/Engineer exceed such unpaid balance of the contract price, the Contractor and his or her Surety shall pay the difference to the Principal Representative.

2. The Principal Representative may require the Surety on the Contractor's bond to take control of the Work and see to it that all the deficiencies of the Contractor are made good, with due diligence within ten (10) days of delivery of Notice to the Surety to do so. As between the Principal Representative and the Surety, the cost of making good such deficiencies shall all be borne by the Surety. If the Surety takes over the Work, either by election upon termination of the services of the Contractor pursuant to Section B(1) of this Article 49, State's Right To Terminate Contract, or upon instructions from the Principal Representative to do so, the provisions of the Contract Documents shall govern the work to be done by the Surety, the Surety being substituted for the Contractor as to such provisions, including provisions as to payment for the Work, the times of completion and provisions of this Article as to the right of the Principal Representative to do the Work or to take control of all or a portion of the Work.

3. The Principal Representative may take control of all or a portion of the Work and make good the deficiencies of the Contractor, or the Surety if the Surety has been substituted for the Contractor, with or without terminating the Contract, employing such additional help as the Principal Representative deems advisable in accordance with the provisions of Article 48A, State's Right To Do The Work; Temporary Suspension Of Work; Delay Damages. In such event, the Principal Representative shall be entitled to collect from the Contractor and his or her Surety, or to deduct from any payment then or thereafter due the Contractor, the costs incurred in having such deficiencies made good and any damages or expenses incurred through the default of Contractor, provided the Architect/Engineer approves the amount thus charged to the Contractor.

If the Contract is not terminated, a Change Order to the Contract shall be executed, unilaterally if necessary, in accordance with the procedures of Article 35, Changes In The Work.
C. ADDITIONAL CONDITIONS

If any termination by the Principal Representative for cause is later determined to have been improper, the termination shall be automatically converted to and deemed to be a termination by the Principal Representative for convenience and the Contractor shall be limited in recovery to the compensation provided for in Article 50, Termination For Convenience Of State. Termination by the Contractor shall not be subject to such conversion.

ARTICLE 50. TERMINATION FOR CONVENIENCE OF STATE

A. NOTICE OF TERMINATION

The performance of Work under this Contract may be terminated, in whole or from time to time in part, by the State whenever for any reason the Principal Representative shall determine that such termination is in the best interest of State. Termination of work hereunder shall be effected by delivery to the Contractor of a Notice of such termination specifying the extent to which the performance of work under the Contract is terminated and the date upon which such termination becomes effective.

B. PROCEDURES

After receipt of the Notice of termination, the Contractor shall, to the extent appropriate to the termination, cancel outstanding commitments hereunder covering the procurement of materials, supplies, equipment and miscellaneous items. In addition, the Contractor shall exercise all reasonable diligence to accomplish the cancellation or diversion of all applicable outstanding commitments covering personal performance of any work terminated by the Notice. With respect to such canceled commitments, the Contractor agrees to:

1. settle all outstanding liabilities and all claims arising out of such cancellation of commitments, with approval or ratification of the Principal Representative, to the extent he or she may require, which approval or ratification shall be final for all purposes of this clause; and,
2. assign to the State, in the manner, at the time, and to the extent directed by the Principal Representative, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the State shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts.

The Contractor shall submit his or her termination claim to the Principal Representative promptly after receipt of a Notice of termination, but in no event later than three (3) months from the effective date thereof, unless one or more extensions in writing are granted by the Principal Representative upon written request of the Contractor within such three month period or authorized extension thereof. Upon failure of the Contractor to submit his or her termination claim within the time allowed, the Principal Representative may determine, on the basis of information available to him, the amount, if any, due to the Contractor by reason of the termination and shall thereupon pay to the Contractor the amount so determined.

Costs claimed, agreed to, or determined pursuant to the preceding and following paragraph shall be in accordance with the provisions of § 24-107-101, C.R.S., as amended and associated Cost Principles of the Colorado Procurement Rules as in effect on the date of this Contract.

Subject to the preceding provisions, the Contractor and the Principal Representative may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the termination under this clause, which amount or amounts may include any reasonable cancellation charges thereby incurred by the Contractor and any reasonable loss upon outstanding commitments for personal services which he or she is unable to cancel; provided, however, that in connection with any outstanding commitments for personal services which the Contractor is unable to cancel, the Contractor shall have exercised reasonable diligence to divert such commitments to other activities and operations. Any such agreement shall be embodied in an Amendment to this Contract and the Contractor shall be paid the agreed amount.

The State may from time to time, under such terms and conditions as it may prescribe, make partial payments against costs incurred by the Contractor in connection with the termination portion of this
Contract, whenever, in the opinion of the Principal Representative, the aggregate of such payments is within the amount to which the Contractor will be entitled hereunder.

The Contractor agrees to transfer title and deliver to the State, in the manner, at the time, and to the extent, if any, directed by the Principal Representative, such information and items which, if the Contract had been completed, would have been required to be furnished to the State, including:

a. completed or partially completed plans, Drawings and information; and,
b. materials or equipment produced or in process or acquired in connection with the performance of the work terminated by the Notice.

Other than the above, any termination inventory resulting from the termination of the Contract may, with written approval of the Principal Representative, be sold or acquired by the Contractor under the conditions prescribed by and at a price or prices approved by the Principal Representative. The proceeds of any such disposition shall be applied in reduction of any payments to be made by the State to the Contractor under this Contract or shall otherwise be credited to the price or cost of work covered by this Contract or paid in such other manners as the Principal Representative may direct. Pending final disposition of property arising from the termination, the Contractor agrees to take such action as may be necessary, or as the Principal Representative may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the State has or may acquire an interest.

Any disputes as to questions of fact, which may arise hereunder, shall be subject to the Remedies provisions of the Colorado Procurement Code, §§ 24-109-101, et seq., C.R.S., as amended.

ARTICLE 51. CONTRACTOR’S RIGHT TO STOP WORK AND/OR TERMINATE CONTRACT

If the Work shall be stopped under an order of any court or other public authority for a period of three (3) months through no act or fault of the Contractor or of any one employed by him, then the Contractor may on seven (7) days’ written Notice to the Principal Representative and the Architect/Engineer stop work or terminate this Contract and recover from the Principal Representative payment for all work executed, any losses sustained on any plant or material, and a reasonable profit. If the Architect/Engineer shall fail to issue or otherwise act in writing upon any certificate for payment within ten (10) days after it is presented and received by the Architect/Engineer, as provided in Article 31, Applications For Payments, or if the Principal Representative shall fail to pay the Contractor any sum certified that is not disputed in whole or in part by the Principal Representative in writing to the Contractor and the Architect/Engineer within thirty (30) days after the Architect/Engineer’s certification, then the Contractor may on ten (10) days’ written Notice to the Principal Representative and the Architect/Engineer stop work and/or give written Notice of intention to terminate this Contract.

If the Principal Representative shall thereafter fail to pay the Contractor any amount certified by the Architect/Engineer and not disputed in writing by the Principal Representative within ten (10) days after receipt of such Notice, then the Contractor may terminate this Contract and recover from the Principal Representative payment for all work executed, any losses sustained upon any plant or materials, and a reasonable profit. The Principal Representative’s right to dispute an amount certified by the Architect/Engineer shall not relieve the Principal Representative of the obligation to pay amounts not in dispute as certified by the Architect/Engineer.

ARTICLE 52. SPECIAL PROVISIONS

A. CONTROLLER’S APPROVAL CRS 24-30-202(1)

This Contract shall not be deemed valid until it has been approved by the Colorado State Controller or designee.

B. FUND AVAILABILITY CRS 24-30-202(5.5)

Financial obligations of the State payable after the current fiscal year are contingent upon funds for that purpose being appropriated, budgeted, and otherwise made available.
C. **GOVERNMENTAL IMMUNITY**

No term or condition of this contract shall be construed or interpreted as a waiver, express or implied, of any of the immunities, rights, benefits, protections, or other provisions, of the Colorado Governmental Immunity Act, CRS §24-10-101 et seq., or the Federal Tort Claims Act, 28 U.S.C. §§1346(b) and 2671 et seq., as applicable now or hereafter amended.

D. **INDEPENDENT CONTRACTOR 4 CCR 801-2**

Contractor shall perform its duties hereunder as an independent contractor and not as an employee. Neither Contractor nor any agent or employee of Contractor shall be deemed to be an agent or employee of the State. Contractor and its employees and agents are not entitled to unemployment insurance or workers compensation benefits through the State and the State shall not pay for or otherwise provide such coverage for Contractor or any of its agents or employees. Unemployment insurance benefits will be available to Contractor and its employees and agents only if such coverage is made available by Contractor or a third party. Contractor shall pay when due all applicable employment taxes and income taxes and local head taxes incurred pursuant to this contract. Contractor shall not have authorization, express or implied, to bind the State to any agreement, liability or understanding, except as expressly set forth herein. Contractor shall (a) provide and keep in force workers’ compensation and unemployment compensation insurance in the amounts required by law, (b) provide proof thereof when requested by the State, and (c) be solely responsible for its acts and those of its employees and agents.

E. **COMPLIANCE WITH LAW**

Contractor shall strictly comply with all applicable federal and State laws, rules, and regulations in effect or hereafter established, including, without limitation, laws applicable to discrimination and unfair employment practices.

F. **CHOICE OF LAW**

Colorado law, and rules and regulations issued pursuant thereto, shall be applied in the interpretation, execution, and enforcement of this contract. Any provision included or incorporated herein by reference which conflicts with said laws, rules, and regulations shall be null and void. Any provision incorporated herein by reference which purports to negate this or any other Special Provision in whole or in part shall not be valid or enforceable or available in any action at law, whether by way of complaint, defense, or otherwise. Any provision rendered null and void by the operation of this provision shall not invalidate the remainder of this contract, to the extent capable of execution.

G. **BINDING ARBITRATION PROHIBITED**

The State of Colorado does not agree to binding arbitration by any extra-judicial body or person. Any provision to the contrary in this contract or incorporated herein by reference shall be null and void.

H. **SOFTWARE PIRACY PROHIBITION. Governor's Executive Order D 002 00**

State or other public funds payable under this contract shall not be used for the acquisition, operation, or maintenance of computer software in violation of federal copyright laws or applicable licensing restrictions. Contractor hereby certifies and warrants that, during the term of this contract and any extensions, Contractor has and shall maintain in place appropriate systems and controls to prevent such improper use of public funds. If the State determines that Contractor is in violation of this provision, the State may exercise any remedy available at law or in equity or under this contract, including, without limitation, immediate termination of this contract and any remedy consistent with federal copyright laws or applicable licensing restrictions.

I. **EMPLOYEE FINANCIAL INTEREST/CONFLICT OF INTEREST CRS 24-18-201 & CRS 24-50-507**

The signatories aver that to their knowledge, no employee of the State has any personal or beneficial interest whatsoever in the service or property described in this contract. Contractor has no interest and shall not acquire any interest, direct or indirect, that would conflict in any manner or degree with the performance of Contractor’s services and Contractor shall not employ any person having such known interests.
J. VENDOR OFFSET CRS 24-30-202(1) & CRS 24-30-202.4
Subject to CRS §24-30-202.4 (3.5), the State Controller may withhold payment under the State's vendor offset intercept system for debts owed to State agencies for: (a) unpaid child support debts or child support arrearages; (b) unpaid balances of tax, accrued interest, or other charges specified in CRS §39-21-101, et seq.; (c) unpaid loans due to the Student Loan Division of the Department of Higher Education; (d) amounts required to be paid to the Unemployment Compensation Fund; and (e) other unpaid debts owing to the State as a result of final agency determination or judicial action.

K. PUBLIC CONTRACTS FOR SERVICES. CRS §§8-17.5-101. [Not Applicable to agreements relating to the offer, issuance, or sale of securities, investment advisory services or fund management services, sponsored projects, intergovernmental agreements, or information technology services or products and services] Contractor certifies, warrants, and agrees that it does not knowingly employ or contract with an illegal alien who will perform work under this contract and will confirm the employment eligibility of all employees who are newly hired for employment in the United States to perform work under this contract, through participation in the E-Verify Program or the Department program established pursuant to CRS §§8-17.5-102(5)(c), Contractor shall not knowingly employ or contract with an illegal alien to perform work under this contract or enter into a contract with a subcontractor that fails to certify to Contractor that the subcontractor shall not knowingly employ or contract with an illegal alien to perform work under this contract. Contractor (a) shall not use E-Verify Program or Department program procedures to undertake pre-employment screening of job applicants while this contract is being performed, (b) shall notify the subcontractor and the contracting State agency within three days if Contractor has actual knowledge that a subcontractor is employing or contracting with an illegal alien for work under this contract, (c) shall terminate the subcontract if a subcontractor does not stop employing or contracting with the illegal alien within three days of receiving the notice, and (d) shall comply with reasonable requests made in the course of an investigation, undertaken pursuant to CRS §8-17.5-102(5), by the Colorado Department of Labor and Employment. If Contractor participates in the Department program, Contractor shall deliver to the contracting State agency, Institution of Higher Education or political subdivision a written, notarized affirmation, affirming that Contractor has examined the legal work status of such employee, and shall comply with all of the other requirements of the Department program. If Contractor fails to comply with any requirement of this provision or CRS §§8-17.5-101 et seq., the contracting State agency, institution of higher education or political subdivision may terminate this contract for breach and, if so terminated, Contractor shall be liable for damages.

L. PUBLIC CONTRACTS WITH NATURAL PERSONS. CRS §24-76.5-101.
Contractor, if a natural person eighteen (18) years of age or older, hereby swears and affirms under penalty of perjury that he or she (a) is a citizen or otherwise lawfully present in the United States pursuant to federal law, (b) shall comply with the provisions of CRS §24-76.5-101 et seq., and (c) has produced one form of identification required by CRS §24-76.5-103 prior to the effective date of this contract.

ARTICLE 53. MISCELLANEOUS PROVISIONS
A. CONSTRUCTION OF LANGUAGE
The language used in these General Conditions shall be construed as a whole according to its plain meaning, and not strictly for or against any party. Such construction shall, however, construe language to interpret the intent of the parties giving due consideration to the order of precedence noted in Article 2C, Intent of Documents.

B. SEVERABILITY
Provided this Agreement can be executed and performance of the obligations of the Parties accomplished within its intent, the provisions hereof are severable and any provision that is declared invalid or becomes inoperable for any reason shall not affect the validity of any other provision hereof, provided that the Parties can continue to perform their obligations under this Agreement in accordance with its intent.
C. **SECTION HEADINGS**
The captions and headings in this Agreement are for convenience of reference only, and shall not be used to interpret, define, or limit its provisions.

D. **AUTHORITY**
Each person executing the Agreement and its Exhibits in a representative capacity expressly represents and warrants that he or she has been duly authorized by one of the parties to execute the Agreement and has authority to bind said party to the terms and conditions hereof.

E. **INTEGRATION OF UNDERSTANDING**
This Contract is intended as the complete integration of all understandings between the parties and supersedes all prior negotiations, representations, or agreements, whether written or oral. No prior or contemporaneous addition, deletion, or other amendment hereto shall have any force or effect whatsoever, unless embodied herein in writing. No subsequent novation, renewal, addition, deletion, or other amendment hereto shall have any force or effect unless embodied in a written Change Order or Amendment to this Contract.

F. **VENUE**
All suits or actions related to this Agreement shall be filed and proceedings held in the State of Colorado and exclusive venue shall be in the City and County of Denver.

G. **NO THIRD PARTY BENEFICIARIES**
Enforcement of this Agreement and all rights and obligations hereunder are reserved solely to the Parties. Any services or benefits which third parties receive as a result of this Contract are incidental to the Contract, and do not create any rights for such third parties.

H. **WAIVER**
Waiver of any breach under a term, provision, or requirement of this Agreement, or any right or remedy hereunder, whether explicitly or by lack of enforcement, shall not be construed or deemed as a waiver of any subsequent breach of such term, provision or requirement, or of any other term, provision, or requirement.

I. **INDEMNIFICATION**
Contractor shall indemnify, save, and hold harmless the State, its employees and agents, against any and all claims, damages, liability and court awards including costs, expenses, and attorney fees and related costs, incurred as a result of any act or omission by Contractor, or its employees, agents, subcontractors, or assignees pursuant to the terms of this contract.

J. **STATEWIDE CONTRACT MANAGEMENT SYSTEM**
If the maximum amount payable to Architect/Engineer under this Contract is $100,000 or greater, either on the Effective Date or at anytime thereafter, this section shall apply.

Architect/Engineer agrees to be governed, and to abide, by the provisions of CRS 24-102-205, 24-102-206, 24-103-601, 24-103.5-101, 24-105-101, and 24-105-102 concerning the monitoring of vendor performance on state contracts and inclusion of contract performance information in a statewide contract management system.
Architect/Engineer’s performance shall be subject to Evaluation and Review in accordance with the terms and conditions of this Contract, State law, including C.R.S.24-103.5-101, and State Fiscal Rules, Policies and Guidance. Evaluation and Review of Architect/Engineer’s performance shall be part of the normal contract administration process and Architect/Engineer’s performance will be systematically recorded in the statewide Contract Management System. Areas of Evaluation and Review shall include, but shall not be limited to quality, cost and timeliness. Collection of information relevant to the performance of Architect/Engineer’s obligations under this Contract shall be determined by the specific requirements of such obligations and shall include factors tailored to match the requirements of Architect/Engineer’s obligations. Such performance information shall be entered into the statewide Contract Management System at intervals established herein and a final Evaluation, Review and Rating shall be rendered within 30 days of the end of the Contract term. Architect/Engineer shall be notified following each performance Evaluation and Review, and shall address or correct any identified problem in a timely manner and maintain work progress.

Should the final performance Evaluation and Review determine that Architect/Engineer demonstrated a gross failure to meet the performance measures established hereunder, the Executive Director of the Colorado Department of Personnel and Administration (Executive Director), upon request by the Principal Representative, and showing of good cause, may debar Architect/Engineer and prohibit Architect/Engineer from bidding on future contracts. Architect/Engineer may contest the final Evaluation, Review and Rating by: (a) filing rebuttal statements, which may result in either removal or correction of the evaluation (CRS 24-105-102(6)), or (b) under CRS 24-105-102(6), exercising the debarment protest and appeal rights provided in CRS 24-109-106, 107, 201 or 202, which may result in the reversal of the debarment and reinstatement of Architect/Engineer, by the Executive Director, upon a showing of good cause.

ARTICLE 54. OPTIONAL PROVISIONS AND ELECTIONS

The provisions of this Article 54 alter the preceding Articles or enlarge upon them as indicated:

The Principal Representative and or the State Buildings Programs shall mark boxes and initial where applicable.

A. MODIFICATION OF ARTICLE 45. GUARANTEE INSPECTIONS AFTER COMPLETION

If the box below is marked the six month guarantee inspection is not required.

☐ _____ Principal Representative initial

B. MODIFICATION OF ARTICLE 27. LABOR AND WAGES

If the box is marked the Federal Davis-Bacon Act shall be applicable to the Project. The minimum wage rates to be paid on the Project shall be furnished by the Principal Representative and included in the Contract Documents.

☐ _____ Principal Representative initial

C. MODIFICATION OF ARTICLE 39. NON-BINDING DISPUTE RESOLUTION – FACILITATED NEGOTIATIONS

If the box is marked, and initialed by the State as noted, the requirement to participate in facilitated negotiations shall be deleted from this Contract. Article 39, Non-Binding Dispute Resolution – Facilitated Negotiations, shall be deleted in its entirety and all references to the right to the same where ever they appear in the contract shall be similarly deleted. The box may be marked only for projects with an estimated value of less than $500,000.

☐ _____ Principal Representative initial
D. MODIFICATION OF ARTICLE 46. TIME OF COMPLETION AND LIQUIDATED DAMAGES

If an amount is indicated immediately below, liquidated damages shall be applicable to this Project as, and to, the extent shown below. Where an amount is indicated below, liquidated damages shall be assessed in accordance with and pursuant to the terms of Article 46, Time Of Completion And Liquidated Damages, in the amounts and as here indicated. The election of liquidated damages shall limit and control the parties right to damages only to the extent noted.

1. For the inability to use the Project, for each day after the number of calendar days specified in the Contractor’s bid for the Project and the Agreement for achievement of Substantial Completion, until the day that the Project has achieved Substantial Completion and the Notice of Substantial Completion is issued, the Contractor agrees that an amount equal to Two Hundred Fifty and no/100 Dollars ($250.00) shall be assessed against Contractor from amounts due and payable to the Contractor under the Contract, or the Contractor and the Contractor’s Surety shall pay to the Principal Representative such sum for any deficiency, if amounts on account thereof are deducted from remaining amounts due, but amounts remaining are insufficient to cover the entire assessment.

2. For damages related to or arising from additional administrative, technical, supervisory and professional expenses related to and arising from the extended closeout period, for each day in excess of the number of calendar days specified in the Contractor’s bid for the Project and the Agreement to finally complete the Project as defined by the issuance of the Notice of Final Acceptance) after the issuance of the final Notice of Substantial Completion, the Contractor agrees that an amount equal to Two Hundred Fifty and no/100 Dollars ($250.00) shall be assessed against Contractor from amounts due and payable to the Contractor under the Contract, or the Contractor and the Contractor’s Surety shall pay to the Principal Representative such sum for any deficiency, if amounts on account thereof are deducted from remaining amounts due but amounts remaining are insufficient to cover the entire assessment.

E. NOTICE IDENTIFICATION

All Notices pertaining to General Conditions or otherwise required to be given shall be transmitted in writing, to the individuals at the addresses listed below, and shall be deemed duly given when received by the parties at their addresses below or any subsequent persons or addresses provided to the other party in writing.

Notice to Principal Representative:                                                                                        
                                                                                                                                    
With copies to:                                                                                                              
State Buildings Programs (or Delegate)                                                                                       
State of Colorado                                                                                                           
                                                                                                                                    
Notice to Contractor:                                                                                                       
                                                                                                                                    
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1. **GENERAL CONDITIONS, ARTICLE 23. F. SIGN** – **DELETE the entire section.**

2. **GENERAL CONDITIONS, ARTICLE 25 INSURANCE** - **DELETE the entire section and replace with the following:**

The Contractor shall obtain and maintain, at its own expense and for the duration of the contract including any warranty periods under the Contract are satisfied, the insurance coverages set forth below.

By requiring such insurance, the Principal Representative shall not be deemed or construed to have assessed the risk that may be applicable to the Contractor its agents, representatives, employees or subcontractors under this contract. The insurance requirements herein for this Contract in no way limit the indemnity covenants contained in the Contract. The Principal Representative in no way warrants that the limits contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this Contract by the Contractor, its agents, representatives, employees, or subcontractors. The Contractor shall assess its own risks and if it deems appropriate and/or prudent, maintain higher limits and/or broader coverages. The Contractor is not relieved of any liability or other obligations assumed or pursuant to the Contract by reason of its failure to obtain or maintain insurance in sufficient amounts, duration, or types.

**COVERAGES AND LIMITS OF INSURANCE** - Contractor shall provide coverage with limits of liability not less than those stated below.

1. **Commercial General Liability – ISO CG 0001 or equivalent. Coverage to include:**
   - Premises and Operations
   - Explosions, Collapse and Underground Hazards
   - Personal / Advertising Injury
   - Products / Completed Operations
   - Liability assumed under an Insured Contract (including defense costs assumed under contract)
   - Independent Contractors
   - Additional Insured—Owners, Lessees or Contractors Endorsement, ISO Form 2010 (2004 Edition or equivalent)
   - Additional Insured—Owners, Lessees or Contractors Endorsement (Completed Operations), ISO CG 2037 (7/2004 Edition or equivalent)
   - **The policy shall be endorsed to include the following additional insured language on the Additional Insured Endorsements specified above:** “The Regents of the University of Colorado, a Body Corporate, named as an additional insured with respect to liability and defense of suits arising out of the activities performed by, or on behalf of the Contractor, including completed operations”.
   - Commercial General Liability Completed Operations policies must be kept in effect for up to three (3) years after completion of the project. For buildings with a construction cost greater than $99 million, the Commercial General Liability
Completed Operations policies must be kept in effect for up to eight (8) years after the completion of the project.

- An umbrella and/or excess liability policy may be used to meet the minimum liability requirements provided that the coverage is written on a “following form” basis.

<table>
<thead>
<tr>
<th>Liability Limits</th>
<th>General Aggregate</th>
<th>Products/Completed Operation Aggregate</th>
<th>Each Occurrence</th>
<th>Personal/Advertising Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary General Liability</td>
<td>$2,000,000</td>
<td>$2,000,000</td>
<td>$1,000,000</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Umbrella or Excess Liability*</td>
<td>$5,000,000</td>
<td>$5,000,000</td>
<td>$5,000,000</td>
<td>$5,000,000</td>
</tr>
</tbody>
</table>

*Umbrella or Excess Liability does not apply to projects totaling $500,000 or under.

2. **Automobile Liability**

Bodily Injury and Property Damage for any owned, hired, and non-owned vehicles used in the performance of this contract

**Minimum Limits:**

Bodily Injury/Property Damage (Each Accident) $1,000,000

3. **Workers Compensation**

- Statutory Benefits (Coverage A)
- Employers Liability (Coverage B)

a. This requirement shall not apply when a contractor or subcontractor is exempt under Colorado Workers’ Compensation Act., AND when such contractor or subcontractor executes the appropriate sole proprietor waiver form.

**Minimum Limits:**

Coverage A (Workers’ Compensation) Statutory
Coverage B (Employers Liability)

- Each accident $100,000
- Disease each employee $100,000
- Disease policy limit $500,000

4. **Contractors Pollution Liability**

- Coverage shall apply to sudden and gradual pollution conditions resulting from the escape of release of smoke, vapors, fumes, acids, alkalis, toxic chemicals, liquids, or gases, natural gas, waste materials, or other irritants, contaminants, or pollutants (including asbestos). Policy shall cover the Contractor’s completed operations.
- If the coverage is written on a claims-made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this Contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years beginning from the time that work under this contract is completed.
• The policy shall be endorsed to include the following as Additional Insureds: The Regents of the University of Colorado, a Body Corporate, named as an additional insured with respect to liability and defense of suits arising out of the activities performed by, or on behalf of the Construction Manager, including completed operations”.

• Endorsements CA9948 and MCS-90 are required on the Automobile Liability Coverage if the Contractor is transporting any type of hazardous materials.

• Contractors Pollution Liability policies must be kept in effect for up to three (3) years after completion of the project.

Minimum Limits:

<table>
<thead>
<tr>
<th></th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Loss</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Aggregate</td>
<td>2,000,000</td>
</tr>
</tbody>
</table>

5. **Builder’s Risk/ Installation Floater**

Unless otherwise provided or instructed by the Principal Representative, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the project is located, Builder’s Risk Insurance in the amount of the initial contract amount as well as subsequent modifications for the entire project at the site on a replacement cost basis without optional deductibles. This coverage is required for new buildings or additions to existing buildings and for materials and equipment to be installed in existing structures.

- Covered Cause of Loss: Special Form
- Include Theft and Vandalism
- Labor costs to repair damaged work
- Shall be written for 100% of the completed value (replacement cost basis)
- Deductible maximum is $50,000.00
- Waiver of Subrogation is to apply
- The Regents of the University of Colorado, a body corporate, shall be added as Additional Named Insured on Builders Risk.

1. Policy must provide coverage from the time any covered property becomes the responsibility of the Contractor, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation site, or awaiting installation, whether on or off site.

2. The Policy shall be maintained, unless otherwise provided in the contract documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made or until no person or entity other than the Principal Representative has insurable interest in the property to be covered, whichever is later.

3. The Builder’s Risk insurance shall include interests of the Principal Representative, and if applicable, affiliated or associated entities, the General Contractor, subcontractors and subcontractor contractors in the project.

4. Builders’ Risk Coverage shall be on a Special Covered Cause of Loss Form and shall include theft, vandalism, malicious mischief, collapse, false-work, temporary buildings and debris removal including demolition, increased cost of construction, architect’s fees and expenses, flood (including water damage), earthquake, and if applicable, all below and above ground structures, piping, foundations including underground water and sewer
mains, piling including the ground on which the structure rests and excavation, backfilling, filling, and grading. Equipment Breakdown Coverage (a.k.a. Boiler & Machinery) shall be included as required by the Contract Documents or by law, which shall specifically cover insured equipment during installation and testing (including hot testing, where applicable). Other coverages may be required if provided in contract documents.

5. The Builders’ Risk shall be written for 100% of the completed value (replacement cost basis) of the work being performed. The Builders’ Risk shall include the following provisions:
   a. Replacement Cost Basis - including modification of the valuation clause to cover all costs needed to repair the structure or work (including overhead and profits) and will pay based on the values figured at the time of rebuilding or repairing, not at the time of loss
   b. Modify or delete exclusion pertaining to damage to interior of building caused by an perils insured against are covered; also provide coverage for water damage

   **Note, if the addition, or renovation is to an existing building, The Principal Representative requires that the Contractor provide as an option to include the existing building into the Builders’ Risk Policy. The Principal Representative shall provide the replacement cost value of the existing building**

6. At the option of the Principal Representative, the Principal Representative may include Soft Costs (including Loss of Use)/Delay in Opening Endorsement under the builder’s risk policy. The Principal Representative agrees to provide the necessary exposure base information for quotation by the Builder’s Risk carrier. The Principal Representative agrees to pay the premium associated with the Soft Costs coverage, the Principal Representative decides to purchase this coverage.

7. The Builders’ Risk Policy shall specifically permit occupancy of the building during construction. Partial occupancy or use of the work shall not commence until the insurance company or companies providing insurance have consented to such partial occupancy or use. The Principal Representative and Contractor shall take reasonable steps to obtain consent of the insurance company or companies and delete any provisions with regard to restrictions within any Occupancy Clauses within the Builders’ Risk Policy. The Builders’ Risk Policy shall remain in force until acceptance of the project by the Principal Representative.

8. The deductible shall not exceed $50,000 and shall be the responsibility of the Contractor except for losses such as flood (not water damage), earthquake, windstorm, tsunami, volcano, etc. Losses in excess of $50,000 insured shall be adjusted in conjunction with the Principal Representative. Any insurance payments/proceeds shall be made payable to the Principal Representative subject to requirements of any applicable mortgagee clause. The Contractor shall pay subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require subcontractors to make payments to their sub-subcontractors in similar manner.

   The Principal Representative shall have the authority to adjust and settle any losses in excess of $50,000 with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Principal Representative exercise of this power. It is expressly agreed that nothing in this section shall be subject to arbitration and any references to arbitration are expressly deleted.

9. The Policy shall be amended to show 45 days notice of cancellation. Such notice shall be given to the Principal Representative and Contractor. If requested, the Contractor shall file with the Principal Representative a copy of the policy that includes the insurance coverages required in this section. The policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to the Project.
If the Contractor does not intend to purchase such Builder’s Risk Insurance required by the Contract and with all of the coverages in the amount described above, the Contractor shall so inform the Principal Representative as stated in writing prior to commencement of the work. The Principal Representative may then affect insurance that will protect the interests of the Principal Representative, the General Contractor, Subcontractors and sub-tier contractors in the project. Coverages applying shall be the same as stated above including other coverages that may be required by the Principal Representative. The cost shall be charged to the Contractor. Coverage shall be written for 100% of the completed value of the work being performed, with a deductible not to exceed $50,000 per occurrence for most projects.

All deductibles will be assumed by the Contractor. Waiver of Subrogation is to apply against all parties named as insureds, but only to the extent the loss is covered, and Beneficial Occupancy Endorsements are to apply.

If the Principal Representative is damaged by the failure or neglect of the Contractor to purchase or maintain insurance as described above, without so notifying the Principal Representative, then the Contractor shall bear all reasonable costs properly attributable thereto.

ADDITIONAL INSURANCE REQUIREMENTS

1. All insurers must be licensed or approved to do business within the State of Colorado, and unless otherwise specified, all policies must be written on a per occurrence basis.
2. Contractor’s insurance carrier should possess a minimum A.M. Best’s Insurance Guide rating of A- VI.
3. On insurance policies where the Principal Representative are named as additional insureds, the Principal Representative shall be additional insureds to the full limits of liability purchased by the Contractor even if those limits of liability are in excess of those required by this Contract.
4. Contractor shall furnish the Principal Representative with certificates of insurance (ACORD form or equivalent approved by the Principal Representative) as required by this Contract. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and any required endorsements are to be received and approved by the Principal Representative before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Contract or to provide evidence of renewal is a material breach of contract.
5. Upon request by the Principal Representative, Contractor must provide a copy of the actual insurance policy effecting coverage(s) required by the contract.
6. The Contractor’s insurance coverage shall be primary insurance and non-contributory with respect to all other available resources.
7. The Contractor shall advise the Principal Representative in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limit. At their own expense, the Contractor will reinstate the aggregate limits to comply with the minimum requirements and shall furnish to the Principal Representative a new certificate of insurance showing such coverage is in force.
8. Provide a minimum of thirty (30) days advance written notice to the Principal Representative for cancellation, non-renewal, or material changes to policies required under the Contract.

Failure of the Contractor to fully comply with these requirements during the term of the Contract may be considered a material breach of contract and may be cause for immediate termination of the Contract at the option of the Principal Representative. The Principal Representative reserves the right to negotiate additional specific insurance requirements at the time of the contract award.

**Subcontractors**
Contractor’s certificate(s) shall include all subcontractors as additional insureds under its policies or subcontractors shall maintain separate insurance as determined by the Contractor, however, subcontractor’s limits of liability shall not be less than $1,000,000 per occurrence / $2,000,000 aggregate.

**Non-Waiver**
The parties hereto understand and agree that The Principal Representative is relying on, and does not waive or intend to waive by any provision of this Contract, the monetary limitations or any other rights, immunities, and protections provided by the Colorado Governmental Immunity Act, et seq., as from time to time amended, or otherwise available to the Principal Representative or its officers, employees, agents, and volunteers.

**Mutual Cooperation**
The Principal Representative and Contractor shall cooperate with each other in the collection of any insurance proceeds which may be payable in the event of any loss, including the execution and delivery of any proof of loss or other actions required to effect recovery.

**ARTICLE 53. MISCELLANEOUS PROVISIONS** – Statewide Contract Management System - **DELETE the entire section.**

Revised 05/13/11
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

CHANGE ORDER BULLETIN

Change Order Bulletin No: ______________________ Date ______________________
Contractor: _______________________________________________________________
Institution or Agency: University of Colorado at Boulder
Project No./Name: CP121908 – CU – LASP: Tenant Finish
Description of Work: ________________________________________________________

This bulletin is issued to define the scope of revision in drawings and/or specifications for a contemplated change order. The work called for by these revisions shall be in accordance with the requirements of the original contract documents.

Please prepare and submit a proposal for the changes described below. For pricing use State Form SC-6.312. A formal change order State Form SC-6.31 will be issued after approval of your proposal by the Principal Representative and the Architect. Your proposal shall include a statement as to the effect this change will have on the time for completion of the project.

This bulletin is NOT an authorization to proceed.

DESCRIPTION OF CHANGE:

SPECIFICATION REVISIONS:

STATUS OF EXISTING WORK:

PREPARED BY: _____________________________________________________________
ARCHITECT/ENGINEER OR CONTRACTOR

APPROVED BY: _____________________________________________________________
PRINCIPAL REPRESENTATIVE
(INSTITUTION or AGENCY)
CHANGE ORDER PROPOSAL

<table>
<thead>
<tr>
<th>Change Order Proposal No.</th>
<th>Date</th>
<th>Reference</th>
<th>Change Order Bulletin No.</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Colorado at Boulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP121908 – CU – LASP: Tenant Finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PART I - WORK PERFORMED BY CONTRACTOR**

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Direct Labor Costs</td>
<td>$</td>
</tr>
<tr>
<td>2.</td>
<td>Labor Overhead (Direct Labor Burdens) (^%\times Line 1)</td>
<td>$</td>
</tr>
<tr>
<td>3.</td>
<td>Total Contractor’s Labor Costs (Lines 1 and 2)</td>
<td>$</td>
</tr>
<tr>
<td>4.</td>
<td>Direct Materials Costs</td>
<td>$</td>
</tr>
<tr>
<td>5.</td>
<td>Materials Overhead (Delivery Costs &amp; Taxes) (^%\times Line 4)</td>
<td>$</td>
</tr>
<tr>
<td>6.</td>
<td>Total Materials Costs (Lines 4 and 5)</td>
<td>$</td>
</tr>
<tr>
<td>7.</td>
<td>Total Equipment Costs</td>
<td>$</td>
</tr>
<tr>
<td>8.</td>
<td>PART I - TOTAL CONTRACTOR’S L, M &amp; E COSTS (Lines 3, 6 and 7)</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART II - WORK PERFORMED BY SUBCONTRACTOR**

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td>Direct Labor Costs</td>
<td>$</td>
</tr>
<tr>
<td>10.</td>
<td>Labor Overhead (Direct Labor Burdens) (^%\times Line 9)</td>
<td>$</td>
</tr>
<tr>
<td>11.</td>
<td>Total Subcontractor’s Labor Cost (Lines 9 and 10)</td>
<td>$</td>
</tr>
<tr>
<td>12.</td>
<td>Direct Materials Costs</td>
<td>$</td>
</tr>
<tr>
<td>13.</td>
<td>Materials Overhead (Delivery Costs &amp; Taxes) (^%\times Line 12)</td>
<td>$</td>
</tr>
<tr>
<td>14.</td>
<td>Total Subcontractor’s Materials Costs (Lines 12 and 13)</td>
<td>$</td>
</tr>
<tr>
<td>15.</td>
<td>Total Subcontractor’s Equipment Costs</td>
<td>$</td>
</tr>
<tr>
<td>16.</td>
<td>Total Subcontractor’s L, M &amp; E Costs (Lines 11, 14 and 15)</td>
<td>$</td>
</tr>
<tr>
<td>17.</td>
<td>Subcontractor’s Overhead (Indirect Costs), (_\times Line 16)</td>
<td>$</td>
</tr>
<tr>
<td>18.</td>
<td>Subcontractor’s Profit (<em>\times Line 16) or (</em>\times Deduct)</td>
<td>$</td>
</tr>
<tr>
<td>19.</td>
<td>PART II - TOTAL SUBCONTRACTOR’S COSTS (Lines 16, 17 and 18)</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART III - CONTRACTOR’S OVERHEAD & PROFIT**

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>Contractor’s Overhead (Indirect Costs), (_\times Part I Total)</td>
<td>$</td>
</tr>
<tr>
<td>21.</td>
<td>Contractor’s Profit (_\times Part I Total)</td>
<td>$</td>
</tr>
<tr>
<td>22.</td>
<td>PART III - TOTAL CONTRACTOR OVERHEAD &amp; PROFIT (Lines 20 and 21)</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART IV - CONTRACTOR’S MARKUP ON SUBCONTRACTOR**

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.</td>
<td>Contractor’s Commission on Subcontractor (_\times Part II Total)</td>
<td>$</td>
</tr>
<tr>
<td>24.</td>
<td>Contractor’s Profit on Subcontractor (<em>\times Part II Total) or (</em>\times Deduct)</td>
<td>$</td>
</tr>
<tr>
<td>25.</td>
<td>PART IV - TOTAL CONTRACTOR MARKUP ON SUBCONTRACTOR (Lines 23 &amp; 24)</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART V - SUBTOTAL C.O. PROPOSAL**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART VI - CONTRACTOR’S BOND COST**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART VII - GRAND TOTAL CHANGE ORDER PROPOSAL**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$</td>
</tr>
</tbody>
</table>

**PART VIII - CONTRACT TIME**

<table>
<thead>
<tr>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion Date (IS) (IS NOT) EXTENDED</td>
<td>_______ calendar days as a result of this proposal.</td>
</tr>
</tbody>
</table>

**CONTRACTOR’S CERTIFICATE:**

This is to certify that, to the best of my knowledge and belief, the cost/price data submitted in response to the listed C.O. Bulletin, are accurate, complete and current as of

Firm: 
Name & Title: 
Signature: 
Date: 

*The proposal shall remain in full force and effect for a period of _______ calendar days from date of signature.

**PRINCIPAL REPRESENTATIVE**

(Institution or Agency)

---

**ARCHITECT/ENGINEER’S CERTIFICATE:**

This is to certify that I have analyzed the proposal and find, to the best of my knowledge and belief, that the proposal represents current, fair, factual and competitive cost/price data.

Firm: 
Name & title: 
Signature: 
Date: 

---

**STATE BUILDINGS PROGRAMS**

(or Authorized Delegate)
INSTRUCTIONS FOR COMPLETING “CHANGE ORDER PROPOSAL”
COST/PRICE DATA SUMMARY (STATE FORM SC-6.312)

BULLETIN NUMBER/DATED: Insert C.O. Bulletin No. and Date Issued
LEFT HAND BOX: Fill in Contractor’s Name; State Project Number and Title
RIGHT HAND BOX: Fill in Description of Changes from Bulletin, noting exceptions that are listed in the Bulletin but are excluded; i.e., not priced on this form.

PART I - WORK PERFORMED BY CONTRACTOR:
Line 1. Direct Labor Costs: Fill in subtotal of direct labor costs, which includes base rates plus applicable fringe benefits. On Contractor’s letterhead/spreadsheet show costs as follows:

<table>
<thead>
<tr>
<th>Trade</th>
<th>Rate</th>
<th>Hours</th>
<th>Extended Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Direct Labor Costs = $ ____________________

Line 2. Labor Overhead (Direct Labor Burdens, etc.): Fill in as a percentage of Line 1.
Line 4. Direct Materials Costs: Fill in subtotal of direct materials costs. Provide quotes or invoices. On letterhead/spreadsheet, show direct materials costs as follows:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Units</th>
<th>Unit Cost</th>
<th>Extended Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Direct Materials Costs = $ ____________________

Line 5. Materials Overhead: Fill in as percentage of Line 4. Overhead costs include delivery, taxes, insurance costs, etc. (As mutually agreed upon at contract signing)
Line 6. Total Materials Costs: Fill in total of lines 4 and 5.
Line 7. Total Equipment Costs: Fill in total equipment costs including indirect overhead costs in hourly rate - except indirect labor costs. On letterhead/spreadsheet show total equipment costs as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Rate</th>
<th>Hours</th>
<th>Extended Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Equipment Cost = $ ____________________


PART II - WORK PERFORMED BY SUBCONTRACTOR:
Line 9. Direct Labor Costs: Fill in subtotal of direct labor costs, which includes base rates plus applicable fringe benefits. On Subcontractor’s letterhead/spreadsheet show costs by trade, rate, hours and extended costs. See Instructions for line 1.
Line 10. Labor Overhead (Direct Labor Burdens, etc.): Fill in as a percentage of Line 9.
Line 13. Materials Overhead: Fill in as a percentage of Line 12. Overhead costs include delivery, taxes, insurance costs, etc.
Line 15. Total Subcontractor’s Equipment Costs: Fill in total equipment costs including indirect overhead costs in hourly rate - except indirect labor costs. On letterhead/spreadsheet show total equipment costs by description, rate, hours and extended costs. See Instructions for line 7.
Line 16. Total Subcontractor’s Labor, Materials and Equipment (L, M & E) Costs: Fill in total of lines 11, 14 and 15.
Line 17. Subcontractor’s Overhead (Indirect Costs): Fill in as percentage cost of line 16. See Article 35 of General Conditions.

PARTS III THROUGH VIII - Self-explanatory.

CERTIFICATIONS
A. The Contractor, who prepares this proposal form, certifies the cost/price data by signing, dating, and forwarding same to the Architect/Engineer (or Consultant) for further action.
B. The Architect/Engineer (or Consultant) reviews and analyzes the cost/price data for the requirements that these are: 1) currently prevalent, 2) reasonably fair, 3) factually applicable, and 4) equivalently competitive market selling prices. The Architect/Engineer (or Consultant) may negotiate—after receipt of the cost proposal—any or all of the cost elements of the proposal to support a recommendation of acceptance to the Principal Representative. Certification by the A/E (or Consultant) of the above requirements is made upon his signature. The Architect/Engineer (or Consultant) forwards the proposal with the supporting back-up to the Agency.
C. Authority for the Institution or Agency (usually the Principal Representative) reviews the proposal, signs, dates, and forwards to State Buildings Programs or Delegate for final action.
D. State Buildings Programs or Delegate reviews the cost proposal, with all supporting back-up, for technical and procedural requirements and, if in order, signs and dates the proposal.
Change Order No: ____________  Contract ID No. N/A  Date ____________

Contractor: ____________________________________________________________

Institution or Agency: University of Colorado at Boulder

Project No./Name: CP121908 – CU – LASP: Tenant Finish

Your Change Order Proposal(s), dated ____________ is hereby being designated for approval of the following work:

(Note: If more space is needed for description of work, attach additional 8-1/2” x 11” sheets hereto.)

This change order was originated by the Contractor □, Architect/Engineer □, State □, and I/We do hereby recommend acceptance and approval of the change to the Contractor’s Agreement Dated ____________ (Exhibit A) which is by this reference, made a part hereof, and identified as Exhibit _______ with an increase □, a decrease □, no change □, of $ ____________.

The Time of Completion is extended _______ calendar days □, is unchanged □, is reduced □ calendar days, from the total number of days listed in the Contractor’s Agreement to complete the entire Project. The revised total number of days to complete the entire Project aggregating this Change Order and previously approved Change Order(s) per the Summary of Changes chart below, is _______ calendar days. If the completion date was extended or reduced, the new completion date of the Project is _______ (M/D/YYYY).

<table>
<thead>
<tr>
<th>Description of Work/Date</th>
<th>Time of Completion/Calendar Days Extended/Reduced</th>
<th>Dollar Amounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Contract (Exhibit A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Order #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Order #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Totals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
*Persons signing for Architect/Engineer/Contractor hereby swear and affirm that they are authorized to act on Architect/Engineer/Contractor’s behalf and acknowledge that the State is relying on their representations to that effect. **Principal is not a recognized title and will not be accepted.**

<table>
<thead>
<tr>
<th>BurkettDesign, Inc.</th>
<th>Name and Title (print)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect/Engineer Firm</td>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contractor (Name of Firm)</th>
<th>Name and Title (print)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>University of Colorado</th>
<th>Ronald L. Ried, Director, Facilities Management Business Services</th>
<th>Principal Representative (Signature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution or Agency</td>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Name and Title (print)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONTRACT STATUS**

<table>
<thead>
<tr>
<th>Original Contract Value</th>
<th>STATE BUILDINGS PROGRAMS</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous increases by CO/Amend</td>
<td>Paul M. Leef, AIA, LEED TM AP</td>
<td></td>
</tr>
<tr>
<td>Previous decreases by CO/Amend</td>
<td>Director, Planning, Design &amp; Construction</td>
<td></td>
</tr>
<tr>
<td>Value After Prior CO’s/Amend</td>
<td></td>
<td></td>
</tr>
<tr>
<td>This CO/Amend</td>
<td>STATE CONTROLLER</td>
<td>Date</td>
</tr>
<tr>
<td>Increases □</td>
<td>(or Authorized Delegate)</td>
<td></td>
</tr>
<tr>
<td>Decreases □</td>
<td>Steve McNally, Associates Vice Chancellor &amp; Controller</td>
<td></td>
</tr>
<tr>
<td>CURRENT CONTRACT VALUE</td>
<td>(Verification)</td>
<td></td>
</tr>
</tbody>
</table>

State Form SC-6.31
Rev. 7/2010
Page 2 of 2
**ENVIRONMENTAL SITE ASSESSMENT FORM**

**Building & Location**
CAMP_  

**Job Description**
Description of work that will be done

**Work Order / Project Number**
MY010905

**Follow-up required for:**
- ASBESTOS MATERIALS
- RADIOACTIVE MATERIALS
- ENVIRONMENTAL COMPLIANCE
- LEAD MATERIALS
- LASER OR X-RAY
- HAZARDOUS MATERIALS

**Suspect Building Components, Materials, and Site Conditions:**
Lists all suspect materials for asbestos and/or lead-based paint. Also describes any other environmental and safety conditions, e.g. laboratory, hazardous materials, radiation issues, etc. Will address other conditions of the building being worked in, e.g. classroom, offices, laboratories, or other uses.

**SAMPLE REPORT ONLY**

**Samples / Results:**
Lists all known results of suspect materials or environmental monitoring results. Where suspect materials are not known, lists these as presumed positive.

**SAMPLE REPORT ONLY**

**REQUIRED ACTION:**
Identifies any action that may be required by all parties for the project, conditions that shall be followed, and all other notations relevant to the project. Explains further steps that must be taken for the project and responsibilities of key project staff, e.g. Project Managers, Contractors, EH&S, etc.

**SAMPLE REPORT ONLY**

**EH&S Inspector:** Certified CDPHE Inspector  
**Date Inspected:** 1/9/2005

**EH&S Manager:** Michael Yanker  
**Date Reviewed:** 1/9/2005

This report is based upon conditions, regulations, policies at time of inspection and is valid for 90 days. Changing scope of work requires re-inspection. If areas contain hazardous materials (asbestos, chemicals, gases, bio-hazards, radioactive materials or radiation) and/or involve laboratories, shops, haz exhausts, tanks, sewer drains or traps, storm or surface water, or other occupational hazards, work must be coordinated with appropriate EH&S manager. No new materials containing asbestos may be used for any part of the construction project. Project must conform with all applicable codes & standards. Project Rep must submit to EH&S Env Compliance - comprehensive haz materials/chemical inventory used to determine additional requirements. Contractor and/or Project Rep must provide above information to employees, subcontractors and other relevant parties.

**University Representative / Project Manager**
**Contractor Name:** Contractor  
**Phone Number:**

**Contractor Representative: (signature)**  
**Foreman or Superintendent**  
**Date Signed:**
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

NOTICE TO PROCEED (DESIGN/BID/BUILD CONTRACT)

Date of Notice: ____________________________________________
(Signature of Principal Representative or Authorized Delegate)

Date to be inserted by the Principal Representative

Date/Description of Contract Documents: __________________________

Institution/Agency: University of Colorado at Boulder

Project No./Name: CP121908 – CU – LASP: Tenant Finish

Attach Notice of Code Compliance from Code Review Agent/Building Official for Documents Listed Above

To:

This is to advise you that your Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance, and Affidavit Regarding Unauthorized Immigrants have been received. Our issuance of this Notice does not relieve you of responsibility to assure that the bond and insurance requirements of the Contract Documents are met for the duration of the Agreement. The Agreement dated ______________ covering the above described work has been fully executed.

You are hereby authorized and directed to proceed within ten (10) days from date of this Notice as required in the Agreement. Any liquidated damages for failure to achieve Substantial Completion by the date agreed that may be applicable to this Contract will be calculated using the date of this Notice for the date of the commencement of the Work.

The completion date of the Project is ______________ (M/D/YYYY).

By ____________________________ Date By ____________________________ Date
State Buildings Programs Principal Representative
(or Authorized Delegate) (Institution or Agency)
Paul M. Leef, AIA, LEED TM AP Ronald L. Ried, Director
Campus Architect & Facilities Management Business Services
Director, Planning, Design & Construction

When completely executed, this form is to be sent by certified mail to the Contractor by the Principal Representative; or by any other means to which the parties agree.
## NOTICE TO PROCEED (DESIGN/BID/BUILD CONTRACT)

<table>
<thead>
<tr>
<th>Date of Notice:</th>
<th>____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date to be inserted by the Principal Representative</td>
<td></td>
</tr>
</tbody>
</table>

**Date/Description of Contract Documents:**

<table>
<thead>
<tr>
<th>Institution/Agency:</th>
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**The completion date of the Project is ________________ (M/D/YYYY).**

<table>
<thead>
<tr>
<th>By</th>
<th>State Buildings Programs Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(or Authorized Delegate)</td>
</tr>
<tr>
<td></td>
<td>Paul M. Leef, AIA, LEED TM AP</td>
</tr>
<tr>
<td></td>
<td>Campus Architect &amp;</td>
</tr>
<tr>
<td></td>
<td>Director, Planning, Design &amp; Construction</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>By</th>
<th>Principal Representative Date</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td></td>
<td>Ronald L. Ried, Director</td>
</tr>
<tr>
<td></td>
<td>Facilities Management Business Services</td>
</tr>
</tbody>
</table>

When completely executed, this form is to be sent by certified mail to the Contractor by the Principal Representative; or by any other means to which the parties agree.
A. CERTIFICATION STATEMENT  
CRS 8-17.5-101 & 102 (HB 06-1343, SB 08-193)

The Vendor, whose name and signature appear below, certifies and agrees as follows:

1. The Vendor shall comply with the provisions of CRS 8-17.5-101 et seq. The Vendor shall not knowingly employ or contract with an unauthorized immigrant to perform work for the State or enter into a contract with a subcontractor that knowingly employs or contracts with an unauthorized immigrant.

2. The Vendor certifies that it does not now knowingly employ or contract with an unauthorized immigrant who will perform work under this contract, and that it will participate in either (i) the “E-Verify Program”, jointly administered by the United States Department of Homeland Security and the Social Security Administration, or (ii) the “Department Program” administered by the Colorado Department of Labor and Employment in order to confirm the employment eligibility of all employees who are newly hired to perform work under this contract.

3. The Vendor shall comply with all reasonable requests made in the course of an investigation under CRS 8-17.5-102 by the Colorado Department of Labor and Employment. If the Vendor fails to comply with any requirement of this provision or CRS 8-17.5-101 et seq., the State may terminate work for breach and the Vendor shall be liable for damages to the State.

B. AFFIDAVIT  
CRS 24-76.5-101 (HB 06S-1023)

4. If the Vendor is a sole proprietor, the undersigned hereby swears or affirms under penalty of perjury under the laws of the State of Colorado that (check one):

  □ I am a United States citizen, or
  □ I am a Permanent Resident of the United States, or
  □ I am lawfully present in the United States pursuant to Federal law.

I understand that this sworn statement is required by law because I am a sole proprietor entering into a contract to perform work for the State of Colorado. I understand that state law requires me to provide proof that I am lawfully present in the United States prior to starting work for the State. I further acknowledge that I will comply with the requirements of CRS 24-76.5-101 et seq. and will produce the required form of identification prior to starting work. I acknowledge that making a false, fictitious, or fraudulent statement or representation in this sworn affidavit is punishable under the criminal laws of Colorado as perjury in the second degree under CRS 18-8-503 and it shall constitute a separate criminal offense each time a public benefit is fraudulently received.

CERTIFIED and AGREED to this ______ day of __________, 2011.

VENDOR:

________________________
Vendor Full Legal Name

________________________  _______________________
Signature of Authorized Representative  Title
Notice to Contractors:
ENVIRONMENTAL RESPONSIBILITIES

Given To:

Contractor Project No.

Signature / Date Project Name

Contractors working on the UCB campus must comply with all applicable University, City, State and Federal environmental regulations and standards.

This includes but is not limited to:

➤ Developing and implementing Storm Water Management Plans, obtaining associated permits (i.e. dewatering), and using erosion control techniques and Best Management Practices (BMP’s) to protect drains and sewer systems from inappropriate discharges, paying special attention to preventing any contaminants from entering storm sewers or surface water collection systems.

➤ Properly managing and disposing of hazardous and regulated materials.

➤ Controlling dust, odors, vapors, debris and run-off during project activities.

➤ Reporting spills or releases of hazardous materials immediately! Call 911 and during weekdays report to EH&S 303-492-6025.

You are expected do your part to promote awareness and compliance. Violations can result in serious penalties and fines for contractors!

On the reverse side of this flyer you will find examples of the kinds of environmental and safety issues and practices that often require attention at construction sites.

Questions, Comments or Concerns? – Please Contact:

Environmental Health and Safety 303-492-6025.
CLOSING-OUT CHECKLIST*

Institution or Agency: University of Colorado at Boulder
Architect/Engineer: 
Contractor: 
Project No./Name: CP121908 – CU – LASP: Tenant Finish

After Contractor or Construction Manager is satisfied that work is complete, a date for final review is established. Architect/Engineer inspection is made with Contractor(s) and Principal Representative and State Buildings Programs (SBP) present. Forms are processed as required.

<table>
<thead>
<tr>
<th>DATE COMPLETED</th>
<th>SIGNOFF INITIALS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Final inspections have been made and permission to occupy Project is obtained through SBP Delegate. The Building Inspection Cards are completely signed off and attached.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>1b. If Principal Representative wishes to occupy entire project or portions of Project before completion (Beneficial Occupancy) Project review of condition and responsibility is conducted and noted. (Fill out Form SBP-01 in addition to this form).</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>2. Notify the local fire department of the date the building will be occupied.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>3. Coordination for final utility and service connections, meters, etc., has been made (water, gas, sewer, electricity and telecommunication) and in full operating order.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>4. Sterilization of plumbing systems has been performed.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>5. Operational tests of systems and equipment have been performed as required.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>6. Systems adjustments, such as balancing, equipment operations, etc., have been performed. Reports have been submitted to Architect/Engineer and approved.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>7. State personnel are instructed in system and equipment operations as required by contract.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>8. Instructions, manuals, guides, charts, etc., are transmitted to Principal Representative.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>9. Principal Representative furnish equipment and furnishing are coordinated and placed.</td>
<td>_______</td>
<td></td>
</tr>
<tr>
<td>10. Review drawing, specifications, addenda, change orders, etc. for work to be done and note.</td>
<td>_______</td>
<td></td>
</tr>
</tbody>
</table>
11. On the Contract Close-out Punch List (Form SBP-06) the final punch list items deficient or still required are made by the Architect and includes lists furnished by the consultants and promptly distributed to all parties.

12. Schedule for corrections, deficiencies, and items to be supplied is established by Contractor, Assistant Contractor and trades as to location of specific defects if necessary.

13. Final Change Orders are processed (must be completed prior to contract acceptance.

14. The Principal Representative shall not authorize final payment until all items on the punch lists have been completed, the Notice of Acceptance issued and the Notice of Contractor’s Settlement Date is published.

15. Permanent keying, keys and keying instructions have been performed.

16. Extra materials, spares, etc., are delivered to Principal Representative.

17. Record drawings (as-built) requirements have been submitted to A/E.

18. Guarantee/Warranty requirements are met.

19. All records, reports, files, documents, etc., of construction inspector are in order and turned over to Owner as arranged, and to SBP as applicable.

20. Removal of Contractor’s temporary work; cleanup and debris removal is understood and performed.

21. Post-contract maintenance conditions, such as equipment, landscaping, etc., are understood and arranged for.

* Verification, item by item, as applicable, to be submitted with Notice of Acceptance Form SC-6.27.

BurkettDesign, Inc. Date Contractor
Architect/Engineer

Paul M. Leef, AIA, LEED™ AP Date Ronald L. Ried, Director
Campus Architect & Facilities Business Services
Director, Planning, Design & Construction Principal Representative
State Buildings Programs (Institution or Agency)
(or Authorized Delegate)
# PRE-ACCEPTANCE CHECKLIST*

**Institution or Agency:** University of Colorado at Boulder  
**Architect/Engineer:** BurkettDesign, Inc.  
**Contractor:**  
**Project No./Name:** CP121908 – CU – LASP: Tenant Finish  

---

State personnel are instructed in system and equipment operations as required by contract.  

---

<table>
<thead>
<tr>
<th>1. The Notice of Approval of Occupancy/Use has been fully executed and the Inspection Cards are completely signed-off.</th>
<th>DATE COMPLETED</th>
<th>A/E SIGNOFF</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. On the Pre-Acceptance Punch List (Form SBP-06) the final punch list items are noted by the Architect/Engineer.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Schedule for corrections, deficiencies, and items to be supplied are established by Contractor.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Final Change Orders are processed (must be completed prior to Notice of Acceptance).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The Principal Representative shall not authorize final payment until all items on the punch list have been completed, the Notice of Acceptance issued and the Notice of Contractor’s Settlement Date is published.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Permanent keying, keys and keying instructions have been performed.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7. Extra materials as per specifications are delivered to Principal Representative.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. As-built drawings have been submitted to Architect/Engineer.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Guarantee/Warranty documentation requirements are met.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Removal of Contractor’s temporary work including cleanup and debris removal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. State personnel are instructed in system and equipment operations as required by contract.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. All Instructions, manuals, guides, and charts have been transmitted to Principal Representative.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

---

**Architect/Engineer**  
BurkettDesign, Inc.  
**Contractor**  
**State Buildings Programs (or Authorized Delegate)**  
Paul M. Leef, AIA, LEED™ AP  
Campus Architect & Director, Planning, Design & Construction  
**Principal Representative**  
(Institution or Agency)  
Ronald L. Ried, Director  
Facilities Management Business Services

---

*Rev. 7/2008*
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

NOTICE OF SUBSTANTIAL COMPLETION

Date of Substantial Completion: ____________________________

Institution/Agency: University of Colorado at Boulder

Project No./Name: CP121908 – CU – LASP: Tenant Finish

TO: Lonnie Greim, Project Manager
    University of Colorado at Boulder
    Department of Facilities Management
    Campus Box 453 UCB
    Boulder, CO 80309-0453
    (Principal Representative)

And

(Contractor)

This is to advise you that the Work has been reviewed, inspected and determined, to the best knowledge, information and belief of the Architect/Engineer, to be substantially complete as of the date noted above in accordance with the criteria outlined in Article 41 of The General Conditions of the Contract and the Specifications, including without limitation a) suitable for occupancy, b) inspected for code compliance with Building Inspection Records signed by code officials for the State, Inspection Cards completely signed-off or a Temporary Certificate, or Certificate, of Occupancy has been issued, c) determined to be fully and comfortably usable, and d) fully cleaned and appropriate for presentation to the public.

A punch list of work to be completed, work not in compliance with the Drawings or Specifications, and unsatisfactory work is attached hereto, along with the Contractor's schedule for the completion of each and every item identified on the punch list specifying the Subcontractor or trade responsible for the work, and the dates the completion or correction will be commenced and finished within any period indicated in the Agreement for punch list completion prior to Final Acceptance.

Except as stated on the reverse side of this Notice of Substantial Completion, all manufacturers' warranties, other special warranties and the Contractor's one-year obligation to perform remedial work, shall commence on the Date of Substantial Completion noted above.

This Notice of Substantial Completion shall be effective and establish the Date of Substantial Completion only when fully executed on the reverse by the Contractor and the Principal Representative. The Principal Representative accepts the Work as substantially complete as of the Date of Substantial Completion herein noted. The Contractor agrees to complete or correct the Work identified on the attached punch list and to do so in accordance with attached punch list completion schedule.
The responsibilities of the Principal Representative and the Contractor for security, maintenance, heat, utilities, and insurance shall be as specified in the Contract Documents or as otherwise hereafter noted:

Exceptions, if any, to the commencement of warranties shall be:

The attached final punch list consists of _________ pages, and the attached Contractor's schedule showing the dates of commencement and completion of each punch list item consists of _________ pages.

When completely executed, this form shall be sent to the Contractor and the Principal Representative with a copy to State Buildings Programs.
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

NOTICE OF APPROVAL OF OCCUPANCY/USE

Date of Occupancy:  
Institution/Agency:  University of Colorado at Boulder
Project No./Name:  CP121908 – CU – LASP: Tenant Finish

Portion(s) of project for which occupancy is approved:

Type of Occupancy:  

The items identified below if applicable must be completed with before Occupancy is approved.

<table>
<thead>
<tr>
<th>Date Completed</th>
<th>A/E Signoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The Notice of Substantial Completion has been issued and the Building Inspection Record Cards are completely signed-off (or a Temporary Certificate, or Certificate, of Occupancy has been issued and copies attached).</td>
</tr>
<tr>
<td>2a.</td>
<td>Notification has been made to the local Fire Department concerning which portion(s) of the building will be occupied and the date(s).</td>
</tr>
<tr>
<td>2b.</td>
<td>Fire alarms, smoke detection systems and building fire sprinkler systems have been fully checked and are operable.</td>
</tr>
<tr>
<td>2c.</td>
<td>The building’s fire connections must be installed and operable, if applicable.</td>
</tr>
<tr>
<td>3.</td>
<td>Coordination for final utility and service connections and meters (water, gas, sewer, electricity and telecommunication) has been made and systems are in full operating order.</td>
</tr>
<tr>
<td>4.</td>
<td>Sterilization of plumbing systems has been performed.</td>
</tr>
<tr>
<td>5.</td>
<td>Operational test of systems and equipment has been performed as required.</td>
</tr>
<tr>
<td>6.</td>
<td>Systems adjustments such as balancing, equipment operations, etc., have been performed. Reports have been submitted to the Architect/Engineer for approval.</td>
</tr>
<tr>
<td>7.</td>
<td>Principal Representative furnished equipment and furnishings are coordinated and placed.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>8.</td>
<td>All elements left unfinished must be in such condition that there would be no hazard to the health or safety of the occupants.</td>
</tr>
<tr>
<td>9.</td>
<td>All restroom facilities must be fully functional and operable.</td>
</tr>
<tr>
<td>10.</td>
<td>All light fixtures must be installed and operable.</td>
</tr>
<tr>
<td>11.</td>
<td>All exit lights and emergency lighting systems have been checked and are operable.</td>
</tr>
<tr>
<td>12.</td>
<td>All windows have been glazed and hardware is available for ventilation purposes.</td>
</tr>
<tr>
<td>13.</td>
<td>All routes of egress must be clear of construction materials and debris at all times.</td>
</tr>
<tr>
<td>14.</td>
<td>There must be a means of pedestrian access to each building. Contractor must have sidewalks installed before occupancy and pedestrian barricades and other means of public protection as required.</td>
</tr>
</tbody>
</table>

Occupancy does not constitute acceptance of the project as being complete. It simply provides the Principal Representative the opportunity to occupy/use the project or the applicable portion thereof prior to final completion and acceptance. Occupants can expect to be impacted by the Contractor’s efforts to complete the project. The Contractor would not repair any damage caused by the occupants.

<table>
<thead>
<tr>
<th>Architect/Engineer</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BurkettDesign, Inc.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Principal Representative (Institution or Agency)</th>
<th>Date</th>
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<tbody>
<tr>
<td>Ronald L. Ried, Director</td>
<td></td>
</tr>
<tr>
<td>Facilities Management Business Services</td>
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<tr>
<th>State Buildings Programs (or Authorized Delegate)</th>
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<tr>
<td>Paul M. Leef, AIA, LEED TM AP</td>
<td></td>
</tr>
<tr>
<td>Campus Architect &amp; Director, Planning, Design &amp; Construction</td>
<td></td>
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<table>
<thead>
<tr>
<th>Contractor</th>
<th>Date</th>
</tr>
</thead>
</table>

State Form SBP-01
Rev. 7/2008
Page 2 of 2
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

NOTICE OF CONTRACTOR’S SETTLEMENT

Institution/Agency: University of Colorado at Boulder
Notice Number:
Project No./Title: CP121908 – CU – LASP: Tenant Finish

Notice is hereby given that on , 201
30th Street, Room 303, Campus Box 453 UCB, Boulder, CO 80309, final settlement will be made by the STATE OF COLORADO with hereinafter called the "CONTRACTOR", for and on account of the contract for the construction of a PROJECT as referenced above.

1. Any person, co-partnership, association or corporation who has an unpaid claim against the said project, for or on account of the furnishing of labor, materials, team hire, sustenance, provisions, provender, rental machinery, tools or equipment and other supplies used or consumed by such Contractor or any of his subcontractors In or about the performance of said work, may at any time up to and including said time of such final settlement, file a verified statement of the amount due and unpaid on account of such claim

2. All such claims shall be filed with the Authority for College, Institution, Department or Agency.

3. Failure on the part of a creditor to file such statement prior to such final settlement will relieve the State of Colorado from any and all liability for such claim.

Authorized Facility Manager or Authorized Individual

Name: Lonnie Greim, Project Manager
Agency: University of Colorado at Boulder
Phone: 303-440-0212
Fax: 303-492-4082
Email: Lonnie.greim@colorado.edu (project manager)

MEDIA OF PUBLICATION:

PUBLICATION DATE:

NOTES TO EDITOR:

Transmit one copy of the Affidavit of Publication, and invoice, to: Marsha Slepicka, University of Colorado at Boulder, Department of Facilities Management, Campus Box 453 UCB, Boulder, CO 80309-0453.
This form to be used after follow-up inspections have been made and punch list is worked down to less than ten items:

<table>
<thead>
<tr>
<th>Final Punch List Item</th>
<th>Disposition</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
</table>

Contractor: BurkettDesign, Inc.  
Architect/Engineer  
Date

Paul M. Leef, AIA, LEED™ AP  
Campus Architect &  
Director, Planning, Design & Construction  
State Buildings Programs  
(or Authorized Delegate)  
Date

Ronald L. Ried, Director  
Facilities Business Services  
Principal Representative  
(Institution or Agency)  
Date
STATE OF COLORADO
OFFICE OF THE STATE ARCHITECT
STATE BUILDINGS PROGRAMS

NOTICE OF FINAL ACCEPTANCE

Date of Notice of Acceptance: ____________________________ Date to be inserted by A/E after consultation with the Principal Representative

Institution/Agency: University of Colorado at Boulder

Project No./Name: CP121908 – CU – LASP: Tenant Finish

TO:

Notice is hereby given that the State of Colorado, acting by and through the Regents of the University of Colorado at Boulder, accepts as complete* the above numbered project.

State Buildings Programs (or Authorized Delegate) Date Principal Representative (Institution or Agency) Date
Paul M. Leef, AIA, LEED AP Ronald L. Ried, Director
Campus Architect & Facilities Management Business
Director, Planning, Design & Construction Services

Construction

*When completely executed, this form is to be sent by certified mail to the Contractor by the Principal Representative; or by any other means to which the parties agree.
Post Construction Warranty Report

Project: CP121908 – CU – LASP: Tenant Finish

Warranty Contractor: ________________________________
Date Warranty Begins: _______________ Date Warranty Expires: _______________
Facilities Management FAX No. 303-492-4082 Reported By: __________________________
Campus Box 453 UCB, Boulder, CO 80309-0453 F/M Rep. Informed: _______________________

Date Reported: ________________________ Taken By: __________________________

Extended Warranty Item:

Description of Warranty Item:

Date Reported to Contractor: ____________________________

Contractor Response:

Date of Resolution: ____________________________

Note:

Post construction warranty rpt
## CONTRACTOR'S APPLICATION FOR PAYMENT

### Detail of Schedule of Values

<table>
<thead>
<tr>
<th>(A)</th>
<th>(B)</th>
<th>(C)</th>
<th>(D)</th>
<th>(E)</th>
<th>(F)</th>
<th>(G)</th>
<th>(H)</th>
<th>(I)</th>
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</thead>
<tbody>
<tr>
<td>Item No.</td>
<td>Description of Work</td>
<td>Material</td>
<td>Labor and Other</td>
<td>Totals (C + D)</td>
<td>Materials On-Site Not But Not In Place</td>
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<td>Labor and Other</td>
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CERTIFICATE FOR CONTRACTOR'S PAYMENT

PAY APPLICATION #: TO: P.O. NO: 
CONTRACTOR: 
AGENCY/INSTITUTION: University of Colorado at Boulder 
PROJECT #/TITLE: CP121908 / CU – LASP: Tenant Finish

AMENDMENTS/CHANGE ORDER SUMMARY

<table>
<thead>
<tr>
<th>Prior amendments / Change Orders</th>
<th>Deductions (L)</th>
<th>Additions (M)</th>
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<td>CO#'s:</td>
<td>Total</td>
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<tr>
<td>Approved This Period</td>
<td>Number</td>
<td>Date</td>
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Application is made for Progress for work completed and in place and stored on site on the above Project. As indicated on the following page(s).

<table>
<thead>
<tr>
<th>Original Contract Sum (K/E)</th>
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<tr>
<td>Net Change from Amendments/Change Orders (L + M/E)</td>
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<td>Present Contract Total (N/E)</td>
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<table>
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<tr>
<th>Current to Date Total Amount</th>
<th>Earned (Due to Date (I))</th>
<th>Retainage</th>
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</thead>
<tbody>
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<td>Current to Date Payment Less</td>
<td>Retainage</td>
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<td>Prior Payments Total Amount</td>
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<td>Prior Payments Earned</td>
<td>Prior Payments Less Retainage</td>
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<tr>
<td>Net change by Amendments / Change Orders (L + M)</td>
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<td></td>
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</tbody>
</table>

Contractor certifies that all work and materials included in this estimate complies with the terms and conditions of the construction contract and authorized changes thereto.

ARCHITECTS/ENGINEER'S CERTIFICATION

In accordance with the Contract and this Application for Payment, the above Contractor is entitled to a payment of: $0.00

[Signatures and dates for various parties]
### Project Submittal Log

**Project:** CP121908 / CU – LASP: Tenant Finish

<table>
<thead>
<tr>
<th>Spec. Section No.</th>
<th>Sub No.</th>
<th>Contr No.</th>
<th>Description</th>
<th>Contr/ SUB Contr</th>
<th>Submit Date</th>
<th>No. of Copies Rec</th>
<th>Action</th>
<th>Date Returned to Architect</th>
<th>Date Returned to Contractor</th>
<th>Distribution copies-Trans</th>
<th>DAYS OUT TO Architect</th>
<th>DAYS OUT TO Contractor</th>
</tr>
</thead>
</table>

**NOTES:**

a. The Submittal Log lists the specification section that requires submittals. It is the Contractor’s responsibility to reference the appropriate subsection of the specification section for specific individual submittal requirements and to submit accordingly.

b. The Submittal Log does not necessarily list all specification sections that require submittals. The Contractor is responsible for any additional submittals that may be called for and required on drawings in the individual schedules and notes.
1.01 CONDITIONS AND REQUIREMENTS

Division 1 - General Requirements shall govern work under all Divisions of the Specifications.

1.02 SPECIFICATION LANGUAGE EXPLANATION

Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Omissions of words or phrases such as "the Contractor shall," "in conformity therewith," "shall be," "as noted on the Drawings," "a," "the" are intentional. Supply omitted words or phrases by inference in same manner as they are when "NOTE" occurs on Drawings. Supply words "shall be" or "shall" by inference when colon is used within sentences or phrases. Supply words "on the Drawings" by inference when "as indicated" is used with sentences or phrases.

Where reference is made to specifications, societies, institutes, or associations or manufacturer's directions, they are, except as may be inconsistent herewith, made part of specifications, to same extent as if written out in full herein. Use latest edition, at time of bidding, if a date is not given.

1.03 SUBMITTALS

A. Prepare data for use by the University of Colorado, Facilities Management personnel.

B. Format:
   1. Submit electronically in Portable Document Format (PDF) format as one document, OCR (Optical Character Recognition) searchable, bookmarked according to the Construction Specifications Institute (CSI) standards.
   2. Title shall be "SPECIFICATIONS", and shall include:
      a. Name of project and submittal stage and date of submittal (month, day, and year).
      b. University of Colorado Project number (Include on cover and in header or footer of each page)

1.04 CONTENT OF MANUAL

A. An electronically-written table of contents shall be provided for each volume, arranged according to CSI standards.
   Include the following:
   1. Name of responsible installing principal contractor, address, and telephone number.

1.05 ABBREVIATIONS

References in Contract Documents to trade associations, technical societies, recognized authorities and other institutions include following organizations, which are sometimes referred to only by corresponding abbreviations:

AA Aluminum Association
AAMA Architectural Aluminum Manufacturer's Association
ACI American Concrete Institute
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>AIMA</td>
<td>Acoustical and Insulating Materials Association (successor to AMA and IBI)</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
</tr>
<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
</tr>
<tr>
<td>AMA</td>
<td>Acoustical Materials Association</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute (successor to USASI and ASA)</td>
</tr>
<tr>
<td>APA</td>
<td>American Plywood Association</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating and Air Conditioning Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing Materials</td>
</tr>
<tr>
<td>AWI</td>
<td>Architectural Woodwork Institute</td>
</tr>
<tr>
<td>AWPA</td>
<td>American Wood Preservers Association</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society</td>
</tr>
<tr>
<td>CDA</td>
<td>Copper Development Associations, Inc.</td>
</tr>
<tr>
<td>CM/GC</td>
<td>Construction Manager/General Contractor</td>
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<tr>
<td>CRA</td>
<td>California Redwood Association</td>
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<tr>
<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<tr>
<td>CS</td>
<td>Commercial Standard (U.S. Department of Commerce)</td>
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<td>DFPA</td>
<td>Douglas Fir Plywood Association</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>FOMA</td>
<td>Flat Glass Marketing Association</td>
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<td>FIA</td>
<td>Factory Insurance Association</td>
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<tr>
<td>FM</td>
<td>Factory Mutual Engineering Division</td>
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<td>Federal Specification</td>
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<td>MIA</td>
<td>Marble Institute of America</td>
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<tr>
<td>MIL</td>
<td>Military Specification</td>
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<tr>
<td>NAAMM</td>
<td>The National Association of Architectural Metal Manufacturers</td>
</tr>
<tr>
<td>NBFU</td>
<td>National Board of Fire Underwriters</td>
</tr>
<tr>
<td>NBS</td>
<td>National Bureau of Standards</td>
</tr>
<tr>
<td>NCMA</td>
<td>National Concrete Masonry Association</td>
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<tr>
<td>NEC</td>
<td>National Electric Code (of NBFU)</td>
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<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers' Association</td>
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<tr>
<td>NFPA</td>
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<tr>
<td>NIOSH</td>
<td>National Institute of Occupational Safety and Health</td>
</tr>
<tr>
<td>NMWIA</td>
<td>National Mineral Wool Insulation Association</td>
</tr>
<tr>
<td>NPVLMA</td>
<td>National Paint, Varnish and Lacquer Manufacturers' Association</td>
</tr>
<tr>
<td>NTMA</td>
<td>The National Terrazzo and Mosaic Association</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PCA</td>
<td>Portland Cement Association</td>
</tr>
<tr>
<td>PCI</td>
<td>Prestressed Concrete Institute</td>
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<tr>
<td>PEI</td>
<td>Porcelain Enamel Institute</td>
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<tr>
<td>PS</td>
<td>Product Standard (U.S. Department of Commerce)</td>
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<td>SCPI</td>
<td>Structural Clay Products Institute</td>
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<tr>
<td>SDI</td>
<td>Steel Deck Institute</td>
</tr>
<tr>
<td>SJI</td>
<td>Steel Joist Institute</td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractor's National Association</td>
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<tr>
<td>SPA</td>
<td>Southern Pine Association</td>
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<tr>
<td>SPI</td>
<td>The Society of Plastic Industry, Inc.</td>
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<tr>
<td>SPR</td>
<td>Simplified Practice Recommendation (U.S. Department of Commerce)</td>
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<tr>
<td>SSPC</td>
<td>Steel Structures Painting Council</td>
</tr>
<tr>
<td>SWI</td>
<td>Steel Window Institute</td>
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</table>
1.04  LAYING OUT WORK

The Contractor will furnish reference bench mark and maintain bench mark and all other grades, lines, and levels and dimensions as indicated in the Contract Documents. Report any errors or inconsistencies in above to Owner before commencing work.

Except as delegated by subcontract or normal trade practice, the Contractor will be responsible for all lines, elevations, and measurements of work indicated.

1.05  EXAMINATION OF SITE

Failure to visit the site will in no way relieve any Contractor from the necessity of furnishing materials or performing work that may be required to complete work in accordance with the Contract Documents without additional cost to Owner.
PART 1 - GENERAL

1.01 SCHEDULE OF DRAWINGS, SPECIFICATIONS AND ADDENDA

The following Drawings, Project Manual, and Addenda from the Contract Documents.

A. Set(s) of Drawings & project manuals dated June 16, 2011. Drawing list is as follows:

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<th>Sheet No. / Titled</th>
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<tr>
<td>General</td>
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<tr>
<td>A0.00 Cover Sheet</td>
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<tr>
<td>A0.01 Code Analysis</td>
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<tr>
<td>A0.02 Wall Types / Details / Door Schedule</td>
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<tr>
<td>Architectural</td>
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<tr>
<td>D2.01 Demolition Plan – First Floor</td>
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<tr>
<td>D2.02 Demolition Plan – Second Floor</td>
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<tr>
<td>A2.01 Construction Plan – First Floor</td>
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<tr>
<td>A2.02 Construction Plan – Second Floor</td>
</tr>
<tr>
<td>A3.01 Reflected Ceiling Plan – First Floor</td>
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<tr>
<td>A3.02 Reflected Ceiling Plan – Second Floor</td>
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<tr>
<td>A5.01 Finish Plan – First Floor</td>
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<td>A8.01 Enlarged Plans / Alternate #2</td>
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<td>A9.01 Details</td>
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<td>M3.0 Mechanical Alternate Plan / Alternate #2</td>
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<td>1-FS01 First Floor Plan / Fire Protection Plan</td>
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<td>1-FS02 Second Floor Plan / Fire Protection Plan</td>
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<td>E0.2 Electrical Schedules</td>
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<td>E0.3 Electrical Schedules</td>
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<td>ED1.1 First Floor Electrical Demo Plan</td>
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<td>ED1.2 Second Floor Electrical Demo Plan</td>
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<td>E1.1 First Floor Electrical Plan</td>
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<tr>
<td>E1.2 Second Floor Electrical Plan</td>
</tr>
<tr>
<td>E2.1 First Floor Lighting Plan</td>
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<tr>
<td>E2.2 Second Floor Lighting Plan</td>
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Structured Cable
T0.01 Technology Title sheet
T0.03 Technology Backbone Riser Diagram
T2.01 First Floor Technology Plan
T2.02 Second Floor Technology Plan
T3.01 TR-W114A Enlarged Technology Plan
T3.02 TR-W117 Enlarged Technology Plan
T3.03 TR-N254 Enlarged Technology Plan
T3.04 TW-W2000 Enlarged Technology Plan
T5.01 Technology Details


C. Addenda: All Addenda issued prior to bidding.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work covered: Work under this contract includes all materials, equipment and labor necessary to complete the work indicated on the drawings, described in specifications, addenda or reasonably inferred.

1.03 CONTRACTORS

All work will be executed under one prime construction contract between the Owner and the Contractor.

Except as indicated otherwise, all work under this contract will be under the direction of the prime contractor.

Separate contracts by Owner of which the General Contractor must coordinate their access and schedules with his own: 1. Fire Alarm Upgrade contractor 2. Office furniture/cubicle installation contractor. 3. Card Reader contractor/installer.

1.04 JOB CONDITIONS

A. Areas of the building immediately adjacent to areas under construction will be occupied by the public during the work of this project. Conduct the work of this project in a manner that will minimize disruption of the Owner's occupancy of adjacent areas.

Limit construction operations to those methods and procedures which will not adversely and unduly affect the Owner's occupied spaces inclusive of parking facilities.

- Third floor is occupied and must not disrupt their operation.
- A Computer Data Center is located on the first floor and must not disrupt their operation.
- Dock area must be accessible to current occupants.
- Contractor access shall be at the Dock Area AND is used by current occupants daily.
- Use freight elevator and stairs to access 2nd floor.
- Construction materials shall be stored within interior construction areas.

B. Do not interrupt building access and use, except as permitted by the Owner.

Provide eight (8) work days notice to the Owner of construction activities which will severely impact the occupancy and use of adjacent areas.

C. Provide temporary barriers and/or partitions as required to protect the occupants of the building and the general public from injury due to the work of this project; and/or to protect adjacent areas of the building from the spread of dust and dirt caused by the work or this project.
SECTION 01010
SUMMARY OF WORK

Remove temporary barriers and partitions upon completion of the Project.
1. Temporary partitions shall be constructed of 1/2" plywood on the construction face nominal 2" X 4" wood studs and 1/2" gypsum wallboard on the public occupied face.

D. Do not interrupt power, lighting, plumbing, telephone and HVAC services to occupied areas without Owner's approval. Such interruptions must be scheduled at least eight (8) work days in advance and have Owner's approval.

1.05 PROTECTION OF WORK AND ADJACENT PROPERTY

A. Buildings and property adjacent to work included in this project may be subject to damage due to construction operations.

Prior to the start of the work included in this Contract engage the services of a photographer to record the existing condition of adjacent structures and property. Contractor shall provide one set set on disk to the Owner and retain negatives and one set of prints for their records. Sufficient photos with adequate detail to thoroughly document the conditions surrounding the work shall be provided.

B. At the completion of the project, Contractor shall restore existing buildings, landscaping, parking facilities and property to same condition as prior to the start of the work.

C. Protect corridors and floor leading to freight elevator and stairs.

D. In addition to the requirements of the General Conditions of the Contract for Construction, the Contractor shall:
   1. Notify, in writing, the Owner of University or private property which interferes with the work and arrange with them for disposition of such property.
   2. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into excavation. Provide temporary protection around openings through and at floors, roofs, and other openings.
   3. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, etc., encountered during excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, incorporated into the work of this project, or can be properly back-filled upon completion of new work.
   4. Contractors are responsible for the security of their own equipment and tools.
5. Weather Protection: Provide protection against rain, snow, wind, ice, storms, or heat so as to maintain work, materials, apparatus, and fixtures free from injury or damage. At the end of each day's work, cover new work likely to be damaged.

6. Provide and maintain adequate protection of the work from damage due to freezing, especially freezing earth and soils. Risk of proceeding with the work on or with freezing or frozen materials will be the sole responsibility of the Contractor.

7. Water Protection: Provide protection from damage at all times from rain water, ground water, backing up of drains or sewers, and other water. Provide pumps and equipment enclosures to provide this protection.

8. The Contractor will maintain free of obstructions and debris, all designated corridors and emergency exits, handicap access ramps and sidewalks to building. Provide temporary directional handicapped signage for routing to the nearest accessible facilities.

1.06 EXISTING FURNITURE AND EQUIPMENT

The Owner will remove or relocate existing movable furniture and equipment from the areas in which the Contractor is working. Notify the Owner not less than three days prior to starting work in areas where furniture and equipment require moving.

1.07 CONTRACTOR'S ACCESS PARKING AND STAGING AREAS

A. Work included in this project will need to be performed within the limitations of available access at the site. The University shall limit the area available for staging and parking due to the additional number of construction projects planned during the execution of this contract. Contractor shall adjust the means and methods of construction to allow for the restrictions surrounding the site.

B. All parking on campus except for some one-hour zones on city streets and a few metered spaces is under control and authority of the Parking and Transportation Services (PTS) of the University. All University parking is by permit only.

C. Types of parking and staging are defined as follows:

General Staging Areas are approved areas adjacent to the site when available or in University designated group staging yards. General Staging Areas may be used for any purpose, including employee parking, on a space available basis, but must be coordinated through the UCB Project Manager and PTS. Vehicles may not park outside of general staging areas except in areas coordinated and approved by PTS.

Restricted Staging Areas are approved areas near the site for the construction dumpster, off-loading of equipment, contractor's work trailer, and materials that are soon to be incorporated into the work. No vehicles shall park in a restricted staging area for more than 20 minutes between the hours of 8:00 a.m. and 5:00 p.m. weekdays.

Contractor Employee Parking are areas for workers needing parking on campus. Coordinate through UCB Project Manager and PTS.

Prohibited Parking are areas designated in the Contract Documents as No Parking areas. The contractor shall not allow any parking in areas so designated under any circumstance.

D. The restrictions in this Section are in addition to any other restrictions or rules provided by PTS. Fees shall be assessed for the use of any PTS facility for staging and construction activities.
The designated staging area for this project shall be: Staging of materials required is assumed to be within the construction limits of the interior construction defined area. Any additional contractor needs for storing of materials shall be off site or by utilizing construction trailers/storage containers and at contractor’s cost. CU Parking Services will charge the contractor for any parking space occupied by such trailer/containers. The General Contractor shall pay for all parking spaces and staging area needed for this project. The monthly charge is $48/parking space per month. If, for example, the fenced staging area consumes 10 spaces, the fee is approx. $480/month. The General Contractor is permitted to freely park within the fenced staging area and manage which subs are to park within the fenced area. Weekly permits are approx. $12.00 per vehicle.

F. Card access to Exterior Doors: The General Contractor and his sub-contractors shall obtain access cards as they deem necessary to access the building beyond normal building’s programmed access times for the exterior entrances. The cost of the cards are $5.00 each.

G. Vehicles parked on sidewalks or in landscape areas outside the designated staging areas cause damage to University property. The contractor shall reimburse the University $25.00 per vehicle per occurrence for vehicles parked outside the designated staging areas. This amount shall be in addition to any fines which might be levied by PTS.

H. Dumpsters, as determined to be needed by the General Contractor, shall be a contractor cost. Location of the dumpster will be coordinated with Parking Services and the number of parking spaces consumed by the Dumpster will be a contractor cost.

1.08 OCCUPANCY REQUIREMENTS

A. Owner may occupy designated areas for the purpose of storage of furnishings and equipment and installation of equipment by other contractors for this project.

B. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Contractor shall allow:
   1. Access for Owner personnel.
   2. Use of parking facilities.
   3. Operation of HVAC and electrical systems.

C. On occupancy, Owner will provide, for occupied areas:
   1. Operation of HVAC and electrical systems.
   3. Security – Exterior doors/card reader access only. Contractor(s) to secure his own access cards @ $5.00/card.

1.09 CONSTRUCTION AND SEQUENCE SCHEDULE:

A. In order to accommodate the uninterrupted operation of the existing building during the various phases of construction, the sequence of construction operations shall be as follows:
   1. The sequence concept is to: (1) prepare the existing facility to function during renovation through completion; (2) thence occupy the newly remodeled portion; and (3) upon completion, finally reoccupy the remodeled portions.
   2. Utilizing this concept break down the Schedule into broad scope categories augmented by “Owner Action” and “Contractor action” columns that indicate coordination tasks which define the various phases of the work.
3. The intent of the categorization is to generally summarize the nature and extent of work to be performed without in any way limiting specific requirements of the Contract Documents. The 2nd flr. Completion of Work has priority over the 1st flr.

1.10 TEMPORARY ELECTRIC SERVICE

A. Connect to existing power service. Power consumption shall not disrupt owners need for service. The third floor is occupied with sensitive electrical/computer equipment. The first floor has a computer data center occupied by many computer servers. **Their power must not be disrupted!** Owner will pay for power. Contractor shall supply all flexible power cords, branch wiring, distribution boxes, etc. for construction operations.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.02 SURVEYS, LAYOUTS, AND LEVELS

A. General: Working from lines and levels established by the existing building, and as shown in relation to the work, establish and maintain bench marks and other dependable markers to set the lines and levels for the work of construction as needed to properly locate every element of the work of the entire project. Calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); do not scale the drawings to determine dimensions. Continuously advise tradesmen performing the work of the marked lines and levels provided for use in the layout of work.

1.03 PROJECT RECORD DOCUMENTS

A. Maintain at job site, one copy of:
   1. Contract Drawings
   2. Specifications
   3. Addenda
   4. Reviewed Shop Drawings
   5. Change Orders
   6. Other Modifications to Contract
   7. Field Test Records
   8. As-Built Drawings

B. Maintain documents in clean, dry, legible condition and do not use record documents for construction purposes. Make documents available at all times for inspection by the Consultant and Owner.

C. Label each document "Project Record" in 1" or larger printed letters.

D. Record drawing information in colored pencil with different colors for the various systems and defined by color legend.

E. Record drawings and specifications shall include the following:
   1. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure. Location of concealed valves, dampers, controls, balancing devices, junction boxes, clean-outs, and other items requiring access or maintenance.
   2. Field changes of dimension and detail, changes made by Change Order or Field Order and details not on original contract drawings.
   3. Fire protection and alarm systems shop drawings.
F. Submit all record drawings to the Consultant at the completion of the project.

1.04 CLEANING

A. Cleaning and Protection Work: At the time each unit of work or element of the construction is completed (substantially) in each area of the Project, clean the unit or element to a condition suitable for occupancy and use (as intended), and restore minor or superficial damage. Replace units and elements which are damaged beyond successful restoration. Clean and restore adjoining surfaces and other work which was soiled or damaged (superficially) during the installation; replace other work damaged beyond successful restoration. Where the performance of subsequent work could possibly result in damage to the complete unit or element, provide protective covering or other provisions to minimize possible damage. Repeat cleaning and protection operations during remainder of construction period, wherever work might otherwise be damaged by sustained soiling or exposure.

B. During Construction: Oversee cleaning and ensure that building, grounds, and public properties are maintained free from accumulation of waste materials and rubbish. At reasonable intervals during daily progress of work, clean up site and access and dispose of waste materials, rubbish, and debris. Vacuum clean interior building areas when ready and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.

1.05 PROJECT SIGN

Erect no project sign or job-site sign of any kind, except warning signs as specified in Section 01500, without written authorization of the Owner.

1.06 COORDINATION

A. The Contractor shall coordinate the work so as not to interfere with the building custodian's normal cleanup activities.

B. The Contractor shall be responsible for coordinating all the work of the project. The Contractor shall coordinate the efforts of all subcontractor(s) and the deliveries of suppliers so that the work progresses in an orderly fashion without delay towards timely completion of a complete project in accordance with the drawings and specifications.

C. The Contractor shall note that concurrent with his work, other contractors, suppliers, and the Owner's facilities and maintenance personnel may be working in relatively close proximity. The Contractor will be solely responsible for coordinating his work with that of other contractors and will make no claims for failure to do so.

1.08 METHODS OF CONSTRUCTION

A. The procedure and method of construction is the prerogative and the responsibility of the Contractor. If professional assistance is required to safely implement method of construction, the Contractor shall, on his own, employ professional help.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL ALTERNATE REQUIREMENTS

A. General: The description for each alternate is recognized to be incomplete and abbreviated but implies that each change must be complete for the scope of work affected. Refer to applicable sections and to applicable drawings for the specific requirements of the owner, whether or not references are so noted in the description of each alternate. Modify surrounding work as required to integrate with the work of each alternate.

1.02 SPECIFIC ALTERNATES

Deductive Alternate No. 1 Description:
Demo/remove existing interior partitions at Floor 1 as indicated.
Demo/remove existing floor/wall finishes.
Demo/remove existing suspended ceiling & lay-in acoustic ceiling tile.

$ ______________________________

Add Alternate No. 2 Description:
Refer to sheet A7.01, A8.01, M3.0 & E3.0
Demo/remove existing interior partitions at Floor 2 as indicated.
Demo/remove existing floor/wall finishes
Demo/remove existing suspended ceiling & lay-in acoustic ceiling tile.
Construct new restroom core as indicated.

$ ______________________________

Alternate No. 3 Description:
Provide alternate pricing for LED source in lieu of fluorescent lamps.
LED shall provide equal lumens and efficiency as the fluorescent fixture.

$ ______________________________

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. General Contractor is responsible for all of the work of this contract.
   1. Assign and subcontract portions of the work as required to assure that all work is
      constructed in compliance with these documents.
   2. Coordinate the work of the several subcontractors for the project.
   3. Coordinate work of this contract with work by separate contractors.

B. Each subcontractor shall:
   1. Coordinate work of his own employees and subcontractors.
   2. Expedite his work to assure compliance with schedules.
   3. Coordinate his work with that of other subcontractors and work by separate contractor.
   4. Comply with orders and instructions of owner.

C. Related Requirements
   1. All Division 1 Sections.

1.02 CONSTRUCTION ORGANIZATION AND START-UP

A. Establish on-site lines of authority and communications.
   1. Attend pre-construction meeting with subcontractors upon commencement of the project.
   2. Establish procedures for intra-project communications.
      a. Submittals.
      b. Reports and records.
      c. Recommendations.
      d. Coordination Drawings.
      e. Schedules.
      f. Resolution of conflicts.
      a. Consult with Architect to obtain interpretation.
      b. Assist in resolution of questions or conflicts which may arise.
      c. Transmit written interpretations to subcontractors, and to other concerned parties.
   4. Assist in obtaining permits and approvals.
      a. Obtain building permits and special permits required for work or for temporary
         facilities.
      b. Verify that subcontractors have obtained inspections for work and for temporary
         facilities.
   5. Control the use of site.
      a. Supervise field engineering and site layout.
      b. Allocate space for each subcontractor's use for field offices, sheds, work and
         storage areas.
      c. Establish access, traffic and parking allocations and regulations.
      d. Monitor use of site during construction.
1.03 CONTRACTOR DUTIES

A. Construction Schedules.
   1. Coordinate schedules with several subcontractors.
   2. Monitor schedules as work progresses.
      a. Identify potential variances between schedules and probable completion dates for each phase.
      b. Recommend adjustments in schedule to meet required completion dates.
      c. Adjust schedules of subcontractors as required.
      d. Document changes in schedule.
   3. Observe work of each subcontractor to monitor compliance with schedule.
      a. Verify that labor and equipment are adequate for the work and the schedule.
      b. Verify that product procurement schedules are adequate.
      c. Verify that product deliveries are adequate to maintain schedule.

B. Process Shop Drawings, Product Data and Samples.
   1. Review for compliance with Contract Documents.
      a. Field dimensions and clearance dimensions.
      b. Relation to available space.
      c. Relation to other trades, equipment and systems.
      d. Submit to Architect.

C. Monitor the use of temporary utilities.
   1. Verify that adequate services are provided and maintained.

D. Inspection and Testing.
   1. Inspect work to assure performance in accord with requirements of Contract Documents.
   2. Administer special testing and inspections of suspected work.
   3. Reject work which does not comply with requirements of Contract Documents.
   4. Coordinate testing laboratory services.
      a. Verify that required laboratory personnel are present.
      b. Verify that tests are made in accordance with specified standards.
      c. Review test reports for compliance with specified criteria.
      d. Recommend and administer required retesting.

E. Monitor contractor's periodic cleaning.
   1. Enforce compliance with specifications.
   2. Resolve any conflicts.

F. Coordinate changes.
   1. Recommend necessary or desirable changes.
   2. Assist owner in negotiating change orders.
   3. Promptly notify all subcontractors of pending changes.

G. Maintain Reports and Records at Job Site available to Architect and Subcontractors.
   1. Log progress of work of each subcontractor.
   2. Records
      a. Contracts.
      b. Purchase orders.
GENERAL REQUIREMENTS

SECTION 01041

PROJECT COORDINATION

GENERAL REQUIREMENTS

DIVISION 1

P	AGE 3

SECTION 01041

PROJECT COORDINATION

GENERAL REQUIREMENTS

DIVISION 1

P	AGE 3

SECTION 01041

PROJECT COORDINATION

Materials and equipment records.

Applicable handbooks, codes and standards.

Obtain information from subcontractors and maintain file of Project Record Documents.

Assemble documentation for handling of claims and disputes.

H. Coordinate work of this Contract and requirements of this section with work by Separate Contract including but not limited to:

1. Removal of asbestos containing materials by separate contract.

1.04 CONTRACT CLOSEOUT

A. Coordinate equipment start-up.

1. Provide seven days notification prior to start-up of each item.

2. Ensure that each piece of equipment or system is ready for operation.

3. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.

4. Perform required testing and balancing.

5. Record dates of start of operation of systems and equipment. Submit written report that equipment or system has been properly installed and is functioning correctly.

6. Provide written notice of beginning of warranty period for equipment put into service.

B. Demonstration and Instructions

1. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to Substantial Completion.

2. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, seasonal operation, and shutdown of each item of equipment.

C. At completion of work of each Section, conduct an inspection to assure that

1. Specified cleaning has been accomplished.

2. Temporary facilities have been removed from site.

D. At completion

1. Conduct an inspection to list work to be completed or corrected.

2. Supervise correction and completion of work as established in Certificate of Completion.

E. When a portion of the Project is occupied prior to final completion, coordinate established responsibilities of each subcontractor.

F. Final completion.

1. When each Subcontractor determines that work is finally complete, conduct an inspection to verify completion of work.

2. Assist owner and architect in inspection.

G. Administer contract closeout.

1. Receive and review Subcontractor's final submittals.

2. Transmit to architect with recommendation for action.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Carefully coordinate the interface between Division 15 (Mechanical) and Division 16 (Electrical) before submitting any equipment for review or commencing installation.

B. Responsibility: Unless otherwise indicated, all motor and controls for Division 15 equipment shall be furnished, set in place and wired in accordance with the following schedule:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FURNISHED UNDER</th>
<th>SET IN PLACE UNDER</th>
<th>POWER WIRING UNDER</th>
<th>CONTROL WIRING UNDER</th>
</tr>
</thead>
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<tr>
<td>Equipment Motor</td>
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<tr>
<td>Automatically Controlled</td>
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<td>Starter/Contractors:</td>
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<td>Separate</td>
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<tr>
<td>Factory Mounted &amp; Wired</td>
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<td>In Motor Control Centers</td>
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<td>Manually Controlled</td>
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<td>Starter/Contractors:</td>
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<tr>
<td>Factory Mounted &amp; Wired</td>
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<td>15</td>
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<tr>
<td>Motor Speed Controllers</td>
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<td>Disconnect (Note 1) Switches</td>
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<td>Contactors</td>
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<td>Thermal Overload (Note 1)</td>
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<td>Manual Operation (Note 2)</td>
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<td>Switches</td>
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<td>Control Relays (Note 2)</td>
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<td>Control Transformers</td>
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<tr>
<td>Control Circuit Outlets</td>
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<tr>
<td>Thermostats (Note 2)</td>
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### GENERAL REQUIREMENTS

**SECTION 01042**

**MECHANICAL AND ELECTRICAL COORDINATION**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FURNISHED UNDER</th>
<th>SET IN PLACE UNDER</th>
<th>POWER WIRING UNDER</th>
<th>CONTROL WIRING UNDER</th>
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<tr>
<td>Time Switches (Note 2) Not in Control Panel</td>
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<tr>
<td>Push Button Stations, Pilot Lights</td>
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<td>Thermostats (Note 2) Controls: Integral with Equipment Directly Applied to Ducts, Pipes, etc.</td>
<td>15</td>
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<tr>
<td>Valve Motors, Damper Motors, Solenoid Valves, etc.</td>
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<td>EP Valves or Switches, P.E. Switches</td>
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<td>Control Circuit Outlets</td>
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<td>Fire Alarm Systems</td>
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<td>Fire Sprinkler Alarm</td>
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<td>Firestats</td>
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<td>Smoke Detectors Including Relays for Fan Control</td>
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<tr>
<td>Control Air Compressor</td>
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<tr>
<td>Refrigerated Air Dryer</td>
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<td>Equipment Interlocks</td>
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<tr>
<td>Boiler and Water Heaters</td>
<td>15</td>
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<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>

**NOTES:**

1. If furnished as part of factory wired equipment furnished and set in place under Division 15, wiring and connections under Division 16.
2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished under Division 15, but they shall be set in place and connected under Division 16 except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be set in place under Division 15 and connected under Division 16. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired under Division 15.
C. Control Wiring: Consists of wiring in pilot circuits of contact or starters, sensors, controllers, and relays, and wiring for valve and damper operators.
   1. Connections: Connections to all controls directly attached to ducts, piping and mechanical equipment shall be made with flexible connections.

D. Starters: Provide magnetic starters for all three phase motors and equipment complete with:
   1. Control transformers.
   2. 120V holding coils.
   3. Integral hand-off-auto switch.
   4. Auxiliary contacts required for system operation plus one (1) spare.

E. Remote Switches and Push Button Stations: Provide all remote switches and/or push button stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.

F. Special Requirements: Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

G. Identification: Provide identification of purpose for each switch and/or push button station furnished. Identification may be either engraved plastic sign or permanent mounting to wall below switch, or stamping on switch cover proper. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate areas.

H. Control Voltage:
   1. Maximum allowable control voltage 120V. Fully protect control circuit conductors in accordance with National Electrical Code.
   2. Provide 20A breakers in emergency panels under Division 16 as required for Building Management System Air Temperature Controls (BMS/ATC). Provide all control transformers, control wiring and connections to circuits under Section 15950 of Division 15.

I. Related Requirements
   1. Section 16480: Electric Motors
      a. Coordinate with efficiency requirements.

J. Contractor must review all concrete embedded items (including conduit) with owner prior to placement.
PART 2 - PRODUCTS

2.01 MOTOR HORSEPOWER

   A. In general, all motors 1/2 HP and above shall be three phase, all motors less than 1/2 HP shall be single phase.

   B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or General Condition 2.01 A., above.

   C. Work under Division 15 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Division 16, before ordering the equipment.

      1. If motor horsepower is changed under the work of Division 15, without a change in duty of the motor's driven device, coordination of additional electrical work (if any) and additional payment for the work (if any) shall be provided under the section of Division 15 initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Engineer.

PART 3 - EXECUTION

NOT USED.
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: This section establishes general requirements in addition to those indicated in the General Conditions of the Contract for Construction pertaining to cutting, fitting, and patching of the work required to:
   1. Make the several parts fit properly.
   2. Uncover work to provide for installation, inspection, or both, of ill-timed work.
   3. Remove and replace work not conforming to requirements of Contract Documents.
   4. Patch new construction into existing construction.

B. Related Work:
   1. In addition to requirements specified, upon the Consultant's request, uncover work to provide for inspection of covered work, and remove samples of installed materials for testing.
   2. Do not cut or alter work performed under separate contract without the Consultant's written permission.

1.02 QUALITY ASSURANCE

A. Perform all cutting and patching in strict accordance with pertinent requirements of the Specifications and, in the event no such requirements are determined, in conformance with the Consultant's written direction.
   1. Use skilled workmen to perform all cutting and patching work.
   2. Use methods least likely to damage existing surfaces and materials to remain, while providing proper surfaces to receive installation of repair, patching, and/or new work.

B. Visual Quality:
   1. Do not cut and patch work exposed to public view, and the exterior and/or interior of the building in a manner that will result in an unacceptable appearance as determined by the Consultant.
   2. Do not cut and patch work in a manner that will result in obvious appearance that cutting and patching work was done.
   3. When cutting existing structural concrete, do not extend saw cuts beyond the corners of the required opening on either side of the opening.

1.03 EXISTING CONSTRUCTION (This building is asbestos free)

A. Where cutting and patching of existing construction is required; prior to start of work, inform Owner of existing construction to be disturbed. Owner will determine if elements of existing construction contain asbestos. Do not proceed with work until after Owner has examined areas to be disturbed. Refer to Exhibit A, Project Pre-Inspection for Possible Presence of Asbestos for additional information concerning the possible presence of materials containing asbestos.

1.04 SUBMITTALS

A. Submit proposed cutting and patching procedures in writing for the following categories of work prior to proceeding with this work: See A/E documents for specific requirements.
1. Cutting new openings in existing structural concrete walls, parapets, and suspended slabs.
2. Cutting new openings in existing roofs and roofing materials.

B. Submittals shall comply with Section 01300.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise indicated in pertinent sections of these specifications, or as directed by the Consultant, use materials which are identical to existing materials in workmanship, appearance, and performance.

B. If identical materials are not available, match existing as closely as possible, especially existing visual characteristics.

PART 3 - EXECUTION

3.01 INSPECTION

A. Before proceeding, inspect existing conditions, including elements subject to movement or damage during cutting, excavating, backfilling, and patching.

B. After uncovering the work, inspect conditions affecting installation of new work.

C. If uncovered conditions are not as anticipated or if existing construction is not as indicated on the Drawings, immediately notify the Consultant for further instructions.

3.02 PREPARATION

A. Provide shoring, bracing, and support as required to maintain structured integrity of the project.

B. Take all necessary action required to protect adjacent existing surfaces from damage due to the work of this section.

C. Take all precautions necessary to protect existing surfaces and materials, new work, and the work of this section from damage due to adverse weather conditions.

D. Provide temporary support of work to cut and adjacent work to prevent failure or damage due to the work of this section.

E. Properly prepare substrate surfaces exposed during cutting as required to receive the work of this or other sections of these specifications in strict compliance with manufacturer's recommendations and these specifications.
3.03 EXECUTION

A. Perform all required cutting and patching as required or reasonably implied under pertinent sections of these specifications.

B. Perform cutting and demolition by methods which will prevent damage to other portions of the work and will provide proper finished installation complying with the specified tolerances and finishes.

3.04 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work. Saw-cut and otherwise isolate areas to be demolished.

B. Repair or otherwise rebuild and/or construct all surfaces affected by cutting and demolition. Execute fitting and adjustment of products to provide totally finished installation to comply with tolerances, finishes, and profiles of adjacent surfaces, whether new or existing.

C. Restore work which has been cut or exposed by demolition; install new construction in compliance with specifications for type of new work to be done or as required to match existing adjacent surfaces. In no case shall any exposed existing surface be left in a raw, marred, or unfinished surface.

D. Refinish entire surfaces as necessary to provide an even finish.
   1. Continuous Surfaces: To nearest intersections.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 - Specification sections, apply to work of this section.

1.02 SUMMARY:

A. Section Includes:
   1. General administrative requirements and procedures and related applicable codes.

1.03 APPROVAL AND RECOMMENDATION AGENCIES:

A. The University of Colorado at Boulder has jurisdiction for the interpretation and enforcement of code requirements for construction of projects.

1.04 CODES:

A. All Contractors shall comply with all applicable codes, ordinances and regulations in effect at the time of bid openings.

APPROVED STATE BUILDING CODES

The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects.

The 2006 edition of the International Building Code (IBC)
(as adopted by the Colorado State Buildings Program as follows: Chapters 2-35 and Appendices C and I)

The 2006 edition of the International Mechanical Code (IMC)
(as adopted by the Colorado State Buildings Program as follows: Chapters 2-15 and Appendix A)

(as adopted by the Colorado State Buildings Program)

The 2008 edition of the National Electrical Code (NEC)
(National Fire Protection Association Standard 70) (as adopted by the Colorado State Electrical Board)

The 2009 edition of the International Plumbing Code (IPC)
(as adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101.2, 102, 105, 107, Chapters 2-13 and Appendices B, D, E, F, and G)

The 2009 edition of the International Fuel Gas Code (IFGC)
(as adopted by the Colorado Examining Board of Plumbers as follows: Chapter 1 Section 101, 102, 105, 107, Chapters 2-8 and Appendices A, B and C)

Please consult the website www.dora.state.co.us/plumbing/index.htm for additional information on the revisions and exceptions to the IPC and IFGC and the inclusion of the new 105 and 107 sections. It is OSA/SBP’s intent to adopt the 2009 International Building Code (IBC), the 2009 International Mechanical Code (IMC), and the 2009 International Energy Conservation Code (IECC) to be implemented at the start of the fiscal year on July 1, 2010.
The National Fire Protection Association Standards (NFPA)

The 2004 edition of the ASME Boiler and Pressure Vessel Code
(as adopted by the Department of Labor and Employment/Boiler Inspection Section as follows: sections I, IV, VIII-Divisions 1 and 2 and 3, X and B31.1)

The 2004 edition of the National Boiler Inspection Code (NBIC)
(as adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2004 edition of the Controls and Safety Devices for Automatically Fired Boilers CSD-1
(as adopted by the Department of Labor and Employment/Boiler Inspection Section)

(as adopted by the Department of Labor and Employment/Boiler Inspection Section)

The 2007 edition of ASME A17.1 Safety Code for Elevators and Escalators
(as adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

The 2005 edition of ASME A17.3 Safety Code for Existing Elevators and Escalators
(as adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

The 2005 edition of ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts
(as adopted by the Department of Labor and Employment/Conveyance Section and as amended by ASME International)

The current edition of the Rules and Regulations Governing the Sanitation of Food Service Establishments
(as adopted by the Department of Public Health and Environment/Colorado State Board of Health)

(as adopted by the Colorado General Assembly as follows: CRS 9-5-101, as amended, for accessible housing)

Note: Additional codes, standards and appendices may be adopted by the state agencies and institutions in addition to the minimum codes and standards herein adopted by State Buildings Programs.

1. The 2006 edition of the IBC became effective on July 1 of 2007. Consult the state electrical and plumbing boards and the state boiler inspector and conveyance administrator and the Division of Fire Safety for adoption of current editions and amendments to their codes.

2. Projects should be designed and plans and specifications should be reviewed based upon the approved codes at the time of A/E contract execution. If an agency prefers to design to a different code such as a newer edition of a code that State Buildings Programs has not yet adopted, the agency must contact SBP for approval and then amend the A/E contract with a revised Exhibit D, Approved State Building Codes. Please note that the state plumbing and electrical boards enforce the editions of their codes that are in effect at the time of permitting not design.
3. The state’s code review agents, or the State Buildings Programs approved agency building official, shall review all documents for compliance with the codes stipulated herein. Note: The Department of Public Health and Environment, Division of Consumer Protection will review drawings for food service related projects.

4. This policy does not prohibit the application of various life safety codes as established by each agency for specific building types and funding requirements. NFPA 101 and other standards notwithstanding, approved codes will supersede where their minimum requirements are the most restrictive in specific situations. If a conflict arises, contact State Buildings Programs for resolution.

5. It is anticipated that compliance with the federal Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) and Colorado Revised Statutes Section 9-5-101 will be met by compliance with the 2006 International Building Code and ICC/ANSI A117.1. However, each project may have unique aspects that may require individual attention to these legislated mandates.

6. The 2003 edition of the International Building Code (IBC) is to be applied to factory-built nonresidential structures as established by the Division of Housing within the Department of Local Affairs.

A. Appendices

Appendices are provided to supplement the basic provisions of the codes. Approved IBC Appendices are as follows:

1. Mandatory
   IBC Appendix Chapter C - Agricultural Buildings
   IBC Appendix Chapter I - Patio Covers

2. Optional
   Any non-mandatory appendix published in the International Building Code may be utilized at the discretion of the agency. Use of an appendix shall be indicated in the project code approach.

B. Amendments

None

C. Referenced Codes

1. While not adopted in entirety, portions of the following codes are referenced in the International Building Code (IBC), the International Mechanical Code (IMC), the International Energy Conservation Code (IECC) the International Plumbing Code (IPC), and the International Fuel Gas Code (IFGC). These following codes would be applied as reference standards.

   2006 International Fire Code (IFC)
   2006 International Existing Building Code (IEBC)
D. Referenced Standards

The IBC, IMC, IECC, IPC and IFGC standards shall be utilized to provide specific, or prescriptive, requirements on how to achieve the requirements established in the code. These standards may be unique to the code or may be derived from other established industry standards. Recognized standards may also be used to show compliance with the standard of duty established by the code.

1.05 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA):

A. The Contractor shall have sole responsibility for compliance on the job site to all applicable portions of the Occupational Safety and Health Act. The Contractor is responsible for other regulatory requirements as they relate to occupational Health and Safety requirements. For example, NIOSH, ANSI, and MSA.

B. Protection of life, health and public welfare as it relates to the execution of the construction contract is the responsibility of the Contractor. The Owner's Representative may, at their discretion, observe, inspect, or comment on plans, procedures, or actions employed at the project as they relate to safety of life, health or public welfare. If conditions are imposed by the Owner which interfere with, or imply actions detrimental to safety, written notice shall be returned to the Owner for action prior to affecting any unsafe conditions.

C. Contractors shall use OSHA Lock Out / Tag Out procedures when working with energized equipment.

D. All contractors entering confined spaces owned by CU or while conducting work under contract with CU shall develop a written program and utilize procedures that, at a minimum, comply with all federal, state and local confined space standards and all applicable regulatory requirements. Contractors shall, independent of the University, monitor the space to obtain their own data to ensure a safe entry and exit. Any data generated by a contractor's confined space entry, should be provided to the Facilities Management confined Space Program Manager.

E. When contractors perform work that may involve Facilities Management controlled permit required confined spaces, Facilities Management will:
   1. Inform contractors of permit required confined spaces and that entry is allowed only after compliance with the confined space entry standard;
   2. Require contractors planning to enter a confined space to provide the Facilities Management Confined Space Program Manager in charge of that space, 48-hour advance notice of such planned entry. The contractors entry will be in accordance with the current Occupational Safety and Health Administration confined space entry standard and a signed document stating such, shall be provided to the FM Confined Space Program Manager prior to entry.

F. The FM Confined Space Program Manager, following receipt of notice of contractor planned entry, will:
   1. Apprise contractor of the hazards identified in the confined space and of any prior experience that is documented on the space;
   2. Appraise the contractor of any precautions or procedures that CU has implemented for the protection of workers in or near the confined space;
   3. Coordinate entry operations with the contractor when both Facilities Management and contractor personnel are working in or around the confined space;
   4. Debrief the contractor at the end of the entry operations regarding hazards confronted or created.
1.06 HOT WORK PERMITS

A. All contractors shall be required to obtain a Hot Work Permit, three (3) working days in advance, for work that involves welding, heat treating, grinding, thawing pipe, hot riveting, soldering and brazing, power driven fasteners and similar activities involving spark, flame or heat. Compliance with the requirements of the applicable fire code, the International Building Code, and NFPA Standard 51B are mandatory and all contractors performing hot work activities shall read and understand these code requirements. To obtain a current Hot Work Permit, go to website: http://fm.colorado.edu/firesafety/hotwork.htm

B. Contractors shall read and comply with the procedures and requirements for Fire Watch, Fire Alarm Interruption and Fire Suppression Interruption as found on the following websites:

Fire Watch Procedures: http://fm.colorado.edu/firesafety/firewatch.htm

Fire Alarm and Detection System Interruption/Outage: http://fm.colorado.edu/firesafety/firealarmdetectsys.htm

Fire Suppression System Interruption/Outage: http://fm.colorado.edu/firesafety/firesuppressionsystems.html

C. No hot work shall be conducted in any campus facility without a hot work permit. Any person or firm who conducts hot work without a permit shall be fined one thousand dollars ($1,000) for each occurrence and their non-permitted activities shall be stopped immediately until they obtain a hot work permit. Contractor shall be responsible for any damages caused as a result of improper hot work activities or the work stoppage.

D. Individuals or firms who obtain a permit shall fully read, understand and implement the requirements of the permit. Any person or firm who conducts hot work without the full implementation of the permit requirements shall be fined five hundred dollars ($500) the first time and one thousand dollars ($1,000) for subsequent occurrences. When the requirements of the hot work permit are not being implemented, the improper activities shall be stopped immediately until a hot work permit is obtained. Contractor shall be responsible for any damages caused as a result of improper hot work activities or the work stoppage. Any contractor who is found to be in non-compliance a third time, will not be allowed to work on campus until further notice by Facilities Management.

E. The campus inspectors, project managers and fire marshal shall have the authority to stop improper or non-permitted hot work activities.

F. The Contractor shall notify the CU Fire Alarm Supervisor to deactivate all smoke alarms in the vicinity of the work prior to any demolition and construction work activity. Failure of the Contractor to comply with the smoke alarm deactivation requirement and cause a false alarm and arrival of the Boulder Fire Department shall be a $400 fine per occurrence.

1.07 PERMITS

A. The contractor must obtain a no fee building permit prior to starting work from Office Manager, Facilities Management at (303) 492-2904 in the Planning, Design and Construction Office, Research Laboratory No. 2, 1540 30th Street, Boulder, Colorado. Building permits are required on all projects except the following:

1. Fences not over 6 feet high & general landscape work
2. Retaining walls which are not over 4 feet in height, unless supporting a surcharge of impounding Class I, II or III-A liquids
3. Platforms, walks and driveways not more than 30 inches above grade and not over any basement or story below.
4. Painting, papering, and similar finish work that meet the requirements of chapter 8 of UBC. (Uniform Building Code).
5. Temporary motion picture, television and theater stage sets and scenery. Review for fire-safety issues is required.

B. The contractor must post the permit(s) in a prominent location at the jobsite including all inspection reports. The contractor shall have an updated set of contract documents available at the jobsite for all inspections.

1.08 INSPECTIONS

A. The Contractor must schedule all required inspections 48 hours in advance by calling (303) 492-2922. CU or their designated inspectors will complete these inspections within 48 hours with the exception of weekends and state holidays.

B. The contractor is required to arrange for the following inspections:

1. Required inspections: General. Reinforcing steel or structural framework of any part of any building of structure shall not be covered or concealed without first obtaining the approval of the building official.
2. Lath or gypsum board inspection: To be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.
3. Final inspection: To be made after finish grading and the building is completed and ready for occupancy.
4. Special inspection: Special inspection may be required on special projects and special types of construction.
5. Re-inspections: A re-inspection fee may be assessed for each inspection or reinspection when such portion of work for which inspection is called is not complete or when corrections called for are not made.

C. The Contractor will be responsible for all cost related to re-inspections and will be billed at a rate of $50.00 per hour for CU re-inspections and at the testing agency bill-out rate for other re-inspections.

1.09 UNIVERSITY OF COLORADO SEXUAL HARASSMENT POLICY

A. Contractors should be aware of and review the University of Colorado at Boulder’s policies that prohibit discrimination and harassment on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation or veteran status. These policies are located on the web at: [http://www.colorado.edu/odh/](http://www.colorado.edu/odh/) Contractor personnel must adhere to these policies and conduct themselves in a manner that does not discriminate or harass as a result of interacting with and around the University of Colorado faculty, staff and students and visitors.

1.10 FIRE ALARM INTERRUPTION

A. Contractor shall contact CU Fire Alarm Systems Supervisor at 303-492-0633 prior to all interruptions or shutdowns of fire alarm systems. Interruptions or shutdowns shall be scheduled three (3) working days in advance with CU Fire Alarm Systems Shop, CU Project Manager and building proctor. Contractor shall provide a fire watch as directed by CU Fire Alarm Systems Shop during interruption or shutdown.
B. The Contractor shall be responsible for preventing nuisance alarm due to activities at their work site. Common sources of nuisance alarms are:
1. Smoke (soldering, welding, cooking, etc.)
2. Grinding
3. Dust (drilling, sweeping, canister vacuums, sand blasting, etc.)
4. Water leaking (plumbing leaks, overflows)
5. Water sprayed on or near detectors (pressure washing or cleaning with water)
6. Popcorn or other food burning in microwaves
7. Static electricity (covering or uncovering detectors)
8. Changing filters on air handling units (dust)
9. Steam (leaks, pressure pop-offs)
10. Broken or frozen sprinkler heads
11. Sprinkler drain valves turned by mistake
12. Vandalism

C. Precautions to prevent nuisance alarms are:
1. During construction projects, treat all buildings, except totally new construction, as though they were occupied buildings with live systems.
2. Do not assume that all detectors are in plain sight. Contact University personnel for verification.
3. Maintain dust control measures per UCB Standards:
   a. Maintaining barriers
   b. Covering air returns
   c. Asking CU personnel to cap or disable smoke detectors (Note any capping or disabling of fire safety devices is to be done ONLY by CU personnel, not contractors.)
   d. Avoiding recirculation of dust or smoke through the building air handling system.
4. Follow campus hot work procedures. Refer to specification Section 01060, paragraph 1.06.
3. Do not expose fire alarm devices to water or extreme temperatures.
4. Contact Fire Systems Group for any actions that affect fire detection, alarm, and suppression systems.

1.11 STORMWATER MANAGEMENT PLAN (SWMP)

A. Stormwater Management Plan (SWMP): Prior to any construction activity disturbing one acre of land or more, an approved SWMP and a Stormwater Permit for Construction Activity application from the Colorado Department of Public Health and Environment (CDPHE) are required. The SWMP shall be prepared in accordance with the CDPHE requirements for “Contents of the Stormwater Management Plan” and the UDFCD’s Urban Storm Drainage Criteria Manual, Volume 3, “Best Management Practices” (UDFCD Drainage Criteria Manual). Stormwater quality management and erosion control measures are to be constructed and maintained in accordance with the SWMP and the UDFCD Drainage Criteria Manual.

1.12 ENVIRONMENTAL/STORMWATER POLLUTION PREVENTION

A. Contractors working on the UCB campus must comply with all applicable University, City, State and Federal environmental regulations and standards. The contractor shall keep material such as saw-cut slurry, drywall mud, grout and mortar, paint, sediment, and all other wastes and process water out of gutters, streets, storm drains and parking lots. The contractor shall also be responsible for proper disposal of all waste materials. Immediately notify 911, EH&S 303-492-6025 and project manager of accidental hazardous materials releases.
B. Contractors are required to locate drains or other water discharge points in the area of the project and provide measures to protect from illicit discharges, prior to construction activities. For assistance with determining where a drain leads to (storm vs. sanitary, especially floor drains), contact the Facilities Management service center at 303-492-5522.

C. The contractor shall be responsible for all costs associated with damages and clean-up as a result of contractor caused illicit discharges of process water or other materials into the storm water system. Also, in addition to any penalties or fines imposed by the City, State or Federal agencies, the contractor shall be fined one thousand dollars ($1,000) by UCB for the first time an incident occurs and may be put on probation from working on campus. The contractor will be prohibited from working on campus, until further notice by UCB, if they are found to be responsible for an illicit discharge a second time.

D. For the purpose of eliminating storm water pollution, the contractor shall implement effective Best Management Practices (BMPs). BMPs include general good housekeeping practices, appropriate scheduling of activities, operational practices, maintenance procedures and other measures to prevent the discharge of pollutants directly or indirectly to the storm water system. These BMPs shall be maintained for the duration of the contractor’s work. Contractors are required to visit website: http://www.bouldercolorado.gov/www/pace/government/index.html for examples of BMP’s that are applicable to project activities. The Contractor shall ensure that all applicable employees and sub-contractors who work on site are trained and comply with storm water pollution prevention methods and proper BMP’s.

E. In addition to the BMP’s the contractor will be required to sign an Environmental Responsibilities form for all projects. The contractor shall post a copy of this form on site, throughout the duration of the project, in a visible area for all workers to see. Also, the contractor will be required to fill out a Pre-Construction Water Quality Certification form indicating any/all potential discharges of process water, chemicals, de-watering, or other materials to sewer systems or landscape areas that are expected to result from project activities.

1.13 UTILITY LOCATES

Contractor MUST CALL 811 (or 1-800-922-1987) for utility locates BEFORE DIGGING on any project at the University of Colorado at Boulder. This includes even small projects such as, but not limited to, planting trees or shrubs, sidewalk removal/installation or fence post installation. Digging without calling can disrupt service to the campus or surrounding neighborhoods and potentially result in fines and repair costs.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Specification system format.
   2. Grammar (syntax) description.

1.02 DESCRIPTION

A. These specifications have been derived from automated specification systems, and include minor deviations from format and traditional writing forms. Such deviations must be recognized as a normal result of this production technique, and no other meaning will be implied or permitted.

B. Imperative language of the technical sections is directed to the Contractor. The term "provide" used repeatedly in the text is defined to mean..."furnish and install, complete, in place and ready for operation and use unless specifically indicated otherwise."

C. Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Omissions of work or phrases such as "the Contractor shall", "in conformity therewith,", "shall be," "as noted on the Drawings", "A", "The", are intentional. Supply omitted words or phrases by inference in same manner as they are when "Note" occurs on Drawings. Supply words "on the Drawings" by inference when "as indicated" is used with sentences or phrases.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Remodel Work scheduling.
   2. Construction sequence scheduling.

B. Related Sections:
   1. Section 01500 - Temporary Facilities and Controls.

1.02 SYSTEM DESCRIPTION

A. An essential condition of this Contract shall be the scheduling and conduct of all phases of construction operations in such a manner that the Owner's operations and use of the existing buildings and campus shall be uninterrupted at all times, except for such limited interruption as is required and approved by the owner.

B. Contractor shall repair at his own expense all damage done to Owner’s property, unknown utilities and adjoining public property as a result of Contractor’s construction activities.

1.03 PROJECT/SITE CONDITIONS

A. Access and use of site:
   1. Contractor shall use the designated site access for construction offices and material storage in such a manner that access to existing buildings and campus remain accessible at all times for use.
   2. Confine operations to as limited a use of the existing building and campus as possible. A route of access to and from the work for employees shall be agreed upon and it shall be the Contractor’s responsibility to see that the agreed route is maintained in order to prevent unwarranted or unnecessary traffic through the existing buildings or site.

B. Owner notice and approval:
   1. All arrangements and scheduling in connection with the work of this Contract shall be made with and subject to the approval of the Consultant and the Owner.
   2. All work under this Contract which will require interruption of service of the existing building shall be scheduled to suit the need and convenience of the Owner’s operation, and arrangements shall be made with the Owner and the Architect at least eight (8) working days in advance of the start of such work.

PART 2 - PRODUCTS

Not Used
PART 3 - EXECUTION

3.01 REMODELING

A. Construction activities of all areas to be constructed in existing facilities shall be completely separated from the rest of the building by dust-proof enclosures erected by Contractor.

B. All surfaces in existing facilities not indicated to be remodeled, or removal of existing items by any Contractor, shall be repaired by the responsible Contractor to match existing adjoining similar surfaces.

3.02 CLEAN-UP

A. All areas within existing facilities, which are not within enclosed areas to be constructed used for access to work areas shall be completely cleaned of all debris and made “broom-clean” at the end of each day’s work.

B. Dust, which permeates areas of existing facilities because of improperly constructed dust-proof barriers, shall be the responsibility of the Contractor. The Contractor shall employ the services of a professional cleaning company to clean any area outside of the designated construction dust barriers that are contaminated by Contractor’s operations. Completely clean all such areas to the satisfaction of the Owner at no additional cost.

END OF SECTION
PART 1 – GENERAL (This is an asbestos free building)

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 - Specification sections, apply to work of this section.

1.02 SUMMARY:

A. Section Includes:
   1. General administrative requirements and procedures for Hazardous Communication Program.

B. Related Sections:
   1. Summary of Work: Section 01010.

1.03 WORK BY OWNER:

A. Asbestos:
   1. The Owner has completed an Environmental Site Assessment to identify asbestos containing materials and other immediate Health and Safety items. Do not begin work until Form Exhibit A (copy following the Supplementary General Conditions) has been executed. Where asbestos materials or other hazardous conditions are known to exist in locations affected by this project, remediation measures will be taken by the Owner under separate contract. The Contractor shall coordinate his sequence and schedule with that of the environmental remediation work.
   2. In the event that the Contractor encounters any material on the site which is reasonably believed hazardous, which has not been rendered harmless, the Contractor shall:
      a. Stop work immediately in affected areas.
      b. Report the condition in writing to the Department of Facilities Management Project Administrator.
      c. Report the condition in writing to the Architect.
      d. Resume work only under the provisions of this section.

1.04 SUBMITTALS:

A. Material Safety Data Sheets (MSDS):
   1. Copies of all material safety data sheets for all applicable products, including but not limited to; paint, adhesives, mastics, solvents, and finishes, etc., shall be retained on site by the Contractor for all applicable products used during the construction and/or remodeling work. Furnish copies of all MSDS’s to the Owner and Architect and include in the Project Record Document submittal.

1.05 QUALITY ASSURANCE:

A. Asbestos containing materials may exist within the general project area where such materials are not expected to be disturbed during the work. The Contractor shall review the Environmental Health and Safety Environmental Site Assessment Form at the project site and become familiar with known asbestos and hazardous containing materials in the work areas.
1.06 PROJECT/SITE CONDITIONS:

A. Hazard Communication Requirements:
   1. All Contractors are responsible for compliance with mandatory federal rules and regulations concerning Hazard Communication, including, but not limited to those regulations contained in 29 CFR 1910.1200 Hazard Communication, 1910.146 Confined Space, 1910.147 Lock-out Tag-out, 1910.1101 Asbestos, and 1926.62 Lead. Contractor and all subcontractors working at sites under the control of the Owner shall make available to the Architect, upon request, copies of the Hazard Communication Program used by their firm. In addition to this requirement, all regulations related to Multi-employer workplaces shall be adhered to. These regulations are found in 29 CFR 1910.1200, (e) (2) (I) through (e) (4) specifically:

   (e) (2) Multi-employer workplaces. Employers who produce, use, or store hazardous chemicals at workplace in such a way that employees of other employer(s) may be exposed (for example, employees of a construction contractor working on site) shall additionally ensure that the hazard communication programs developed and implemented under paragraph (e) include the following:

   (e) (2) (i) The methods the employer will use to provide the other employer(s) with a copy of the material safety data sheet, or to make it available at a central location in the workplace, for each hazardous chemical the other employer(s)' employees may be exposed to while working;

   (e) (2) (ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace’s normal operating conditions and in foreseeable emergencies; and,

   (e) (2) (iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace

(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with requirements of 29 CFR 1910.20 (e).

2. The referenced regulations were excerpted from 29 CFR 1910.1200. This excerpt shall not be relied upon for compliance with mandatory federal, state and local regulations. The Contractor shall comply with all such regulations and shall be solely liable for insuring that all requirements under applicable regulations are met.

PART 2 - PRODUCTS  (Not applicable)

PART 3 - EXECUTION
3.01 EXAMINATION:
A. Asbestos and Hazardous Materials Discovery:
   1. The Contractor is cautioned to be alert to the possibility that his work may uncover asbestos-containing or hazardous materials. If suspected materials are found, the Contractor shall notify the Owner and stop all work in the area immediately. If the suspected materials prove to contain asbestos or hazardous materials, the Owner will arrange to have the materials abated in a timely manner.

3.02 HAZARDOUS MATERIALS/EQUIPMENT REMOVAL:
A. Definition:
   1. Removal of hazardous materials/equipment is extremely dangerous. Hazardous materials/equipment is defined to include, but not limited to the following:
      a. Fume hoods
      b. Hood exhaust duct work
      c. Exhaust fans
      d. Laboratory casework and equipment
      e. PCB ballast’s
      f. Mercury and Sodium Vapor Lights
      g. Adjacent material that could come in contact with workers or public.
B. Protection:
   1. Hazardous materials/equipment removal shall include the protection of personnel, material, environment and safe legal disposal of the equipment; and further includes the following:
      a. Notification of Project Administrator and appropriate Environmental Health and Safety Unit
      b. Proper protective clothing for personnel involved in the removal.
      c. Appropriate emergency and first aid facilities.
      d. Removal procedures shall be accomplished during minimal occupancy of the remainder of the building on the weekends or at night.
C. Disposal:
   1. All equipment related to the use, storage or processing of hazardous materials/equipment shall be removed and properly disposed of under the direct, full-time supervision of a qualified Laboratory Specialist fully conversant with the chemistry and properties of the material/equipment involved. Certification is required. Contractors are responsible for the removal of all hazardous materials/equipment and chemicals from the work site as well as proper disposal of all hazardous waste generated by their project.
   2. Hazardous waste disposal must include prior notification to the Department of Environmental Health and Safety in order to verify that the appropriate procedures and documentation are used. Copies of all paper work for shipping and disposing of these materials (hazardous waste manifests, land disposal restrictions, etc.) will be provided by the Contractor to the Department of Environmental Health & Safety (303) 492-6025. Where appropriate, the Main Campus EPF ID COD007431505 will be used for these shipments.
   3. Hazardous chemicals, waste, and other pollutants may not be discharged to the sanitary or storm sewer systems at anytime. Releases to the environment must be reported to CUPD/EH&S immediately.
PART 1 - GENERAL

1.01 REQUIREMENTS

A. The types and minimum requirements for project meetings are included but are not necessarily limited to the following categories:

- Pre-construction meeting
- Progress and Coordination meetings
- Specially called meetings

B. The pre-construction meeting will be scheduled within fifteen days after date of Notice to Proceed, at a central site location designated by the Owner and convenient for all parties.

1. Attendance:
   a. Owner's Representative
   b. Consultant and his sub-consultants, as applicable
   c. Contractor's Superintendent
   d. Major Subcontractor(s)
   e. Others as appropriate

2. Suggested Agenda:
   a. Distribution and discussion of:
      - List of major subcontractors and suppliers
      - Projected construction schedules
      - Critical work sequencing
      - Major equipment deliveries and priorities
      - Project Coordination
      - Designation of responsible personnel
   b. Procedures and processing of:
      - Field decisions
      - Proposal requests
      - Submittals
      - Change Orders
      - Applications for Payment
   c. Adequacy of Distribution of Contract Documents
   d. Procedure for Maintaining Record Documents
   e. Inspections
   f. Stormwater Management Plan (SWMP)

C. The Architect/Engineer will: Record the minutes; including significant proceedings and decisions.

D. The Contractor shall schedule and administer subcontractor and vendor pre-construction meetings throughout progress of the work. He will:

1. Prepare agenda for meetings.
2. Distribute written notice of each meeting four days in advance of meeting date.
3. Make physical arrangements for meetings.
4. Preside at meeting.
5. Record the minutes; including significant proceedings and decisions.
6. Representatives of Contractors, Subcontractors, and Suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
7. Use of Premises:
   Office, work, staging and storage areas
   Owner's requirements

8. Temporary construction Facilities, Utilities, Controls and Construction Aids

9. Safety, First-aid, Security and Housekeeping Procedures

10. Administrative Procedures and Documents as Required by Owner

1.02 PROGRESS AND COORDINATION MEETING

The Contractor will schedule and administer job progress and coordination meeting at the site.

A. Attendance:
   1. Owner as needed
   2. Consultant and his sub-consultants as needed
   3. Subcontractor as appropriate to the agenda
   4. Suppliers as appropriate to the agenda
   5. Others

B. Suggested Agenda:
   1. Review of work progress since previous meeting.
   2. Field observations, problems and conflicts.
   3. Problems which impede Construction Schedule.
   4. Review of off-site fabrication and delivery schedules.
   5. Corrective measures and procedures to regain projected schedule.
   6. Revisions to Construction Schedule.
   7. Coordination of schedules.
   8. Progress and schedule during succeeding work period.
   9. Review submittal schedules and expedite as required.
  11. Pending changes and substitutions.
  12. Review proposed changes for:
      a. Effect on Construction Schedule and on completion date.
      b. Effect on other contracts of the Project.

C. The Architect/Engineer shall record and distribute the minutes of all progress meetings throughout the construction period and shall visit the site a minimum of once every two weeks. The Architect/Engineer shall average one visit per week during construction.

The structural engineer shall visit the site immediately prior to every major structural concrete slab pour; every major foundation wall pour; at least twice for each major segment of work [i.e., caissons, columns, steel roof joists, etc].

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Submit shop drawings, product data and samples as required by various sections of the specifications.

1.02 QUALITY ASSURANCE

A. Shop Drawings:
   1. Drawings shall be presented in a clear and thorough manner.
   2. Details shall be identified by reference to sheet, detail, schedule, or room numbers shown on drawings.

B. Product Data:
   1. Preparation:
      a. Clearly mark each copy to identify pertinent products or models.
      b. Show performance characteristics and capabilities.
      c. Show dimensions and clearances required.
      d. Show wiring or piping diagrams and controls.
   2. Manufacturer's standard schematic drawings and diagrams.
      a. Modify drawings and diagrams to delete information that is not applicable to the work.
      b. Supplement Standard information to provide information specifically applicable to the work.

C. Samples:
   1. Office samples shall be of sufficient size and quantity to clearly illustrate:
      a. Functional characteristics of the product with integrally related parts and attachment devices.
      b. Full range of color, texture and pattern

D. Mock-ups:
   1. Provide complete mock-up of exterior materials to be incorporated into the work.
      a. Mock-up shall include a sample of all materials used in exterior construction, whether specified elsewhere or not in these documents, including but not limited to, masonry, stone, window systems, precast concrete, roof systems, flashing, sealants, masonry paving, paint and other readily visible materials.
      b. Secure Owner approval of mock-ups prior to ordering and placement of materials. Modify mock-ups as directed by the Architect or Owner until acceptable.
      c. Confirm exact mock-up(s) required by Owner prior to fabrication of mock-up(s).
   2. Remove mock-up at the conclusion of the project or when directed by the Architect.
      a. Restore or finish site to finish condition indicated on the Drawings.

E. Responsibilities of the Contractor:
   1. Review shop drawings, product data, samples and project record drawings for specification performance prior to submission.
2. Determine and Verify:
   a. Field measurements
   b. Field construction criteria
   c. Catalog numbers and similar data
   d. Conformance with specifications
3. Coordinate each submittal with requirements of the work and of the Contract Documents.
4. Notify the Consultant in writing, at the time of submission, of any deviations in the submittals for requirements of the Contract Documents.
5. Begin no fabrication or work that requires submittals until return of submittals with Consultant's acceptance.
6. Contractor’s responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Consultant’s review of submittals.
7. Contractor shall stamp, sign or initial, and date each submittal to show compliance with the Contract Documents prior to submittal to the Consultant.

1.03 SUBMITTALS

A. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the work.

SUBMITTAL LISTING—Provide submittals for the following:

Architectural Submittals

- All Finishes (samples or draw downs) - paint, carpet, tile, vct, ceiling systems, acoustic tile products, plastic laminates, etc.
- Doors, frames and hardware
- Storefront systems
- Appliances

Electrical submittals (ELECTRICAL submittals must be submitted in one package electronically)

- SECTION 26 05 19 – Electrical Power Conductors and Cables
- SECTION 26 05 29 – Hangers and Supports
- SECTION 26 05 33 – Raceway and Boxes
- SECTION 26 27 26 – Wiring Devices
- SECTION 26 28 16 – Enclosed switches, fuses and circuit breakers
- SECTION 26 51 13 – Lighting Fixtures

Mechanical submittals (MECHANICAL submittals must be submitted in one package electronically)

- SECTION 22 07 00 - PLUMBING INSULATION
- SECTION 22 10 00 - PLUMBING PIPING
- SECTION 22 30 00 - PLUMBING EQUIPMENT
- SECTION 22 40 00 - PLUMBING FIXTURES
- SECTION 23 05 21 - PIPE AND PIPE FITTINGS
- SECTION 23 05 22 - PIPING ACCESSORIES
- SECTION 23 05 23 - VALVES
- SECTION 23 05 29 - PIPE SUPPORTS AND ANCHORS
- SECTION 23 07 00 - MECHANICAL INSULATION
- SECTION 23 23 00 - REFRIGERANT PIPING
- SECTION 23 31 13 - DUCTWORK
GENERAL REQUIREMENTS

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SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- SECTION 23 33 00 - DUCTWORK ACCESSORIES
- SECTION 23 34 00 - FANS
- SECTION 23 36 00 - AIR TERMINAL UNITS
- SECTION 23 37 00 - AIR INLETS AND OUTLETS
- SECTION 23 62 13 - AIR-COOLED CONDENSING UNITS
- SECTION 23 73 24 - SPLIT SYSTEM DX AIR HANDLING UNITS

**Fire Sprinkler submittals**
- Provide design stamped drawings with submittals of all components used.

**Technology submittals**
- SECTION 27 00 00 – COMMUNICATIONS
- SECTION 27 01 00 – OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS
- SECTION 27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS
- SECTION 27 05 28 – PATHWAYS FOR COMMUNICATIONS SYSTEMS
- SECTION 27 08 00 – COMMUNICATIONS SYSTEMS COMMISSIONING
- SECTION 27 11 00 – COMMUNICATIONS EQUIPMENT ROOM WORK
- SECTION 27 13 00 – BACKBONE CABLING REQUIREMENTS
- SECTION 27 15 00 – HORIZONTAL CABLING REQUIREMENTS COMMUNICATIONS
- SECTION 27 17 00 – TESTING, IDENTIFICATION AND ADMINISTRATION
- SECTION 27 20 00 – DATA COMMUNICATIONS
- APPENDIX A
- CONSTRUCTION DRAWINGS AS-BUILT REQUIREMENTS
- WIRELESS CEILING AND WALL SECURITY BOX INSTRUCTIONS
- APPROVED RACK DETAILS
- LABELING AND TESTING
- COMPUTER AND TECHNOLOGY SUPPORTING INFORMATION
- UCB ITS TELECOM CAD STANDARD GUIDELINE
- APPENDIX B
- ADDENDUM TO UCB ITS DIVISION 27 STANDARDS ON AUGUST 12, 2010
- APPENDIX 6
- COMPUTER AIDED DRAFTING AND FACILITIES MANAGEMENT STANDARDS 2010-2011

B. Number of Submittals Required:
   1. Shop Drawings: Submit one electronic (pdf) to the owner and the consultant.
   2. Product Data: Submit one electronic (pdf) to the owner and the consultant.
   3. Samples: Submit the number stated in each specification section.

C. Submittals shall contain:
   1. Date of the submission and dates of any previous submissions.
   2. Project title and number.
   4. Names of:
      a. Contractor and Subcontractor(s), if applicable.
      b. Supplier
      c. Manufacturer
   5. Identification of product with the specification section number.
   6. Field dimensions, clearly identified as such.
   7. Relation to adjacent or critical features of the work or materials.
GENERAL REQUIREMENTS

DIVISION 1 - PAGE 4

SECTION 01300 SUBMITTALS, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

8. Applicable standards, such as ASTM or Federal specification numbers.
10. Identification of revisions on resubmittals.
11. An 8"x3" blank space in lower right-hand corner for review stamps.

D. Resubmission Requirements:
1. Make any corrections or changes in the submittals required by the Consultant and resubmit until accepted.
2. Shop drawings and product data:
   a. Revise initial drawings or data and resubmit as specified for initial submittal.
   b. Indicate any changes that have been made, other than those requested by the Consultant.
3. Samples: Submit new samples as required for initial submittal.

E. Distribution:
1. Distribute reproductions of approved shop drawings and copies of product data to affected subcontractors and retain one copy for use at the job-site.
2. Distribute approved samples as directed.

F. Consultant's Duties:
1. Review submittals with reasonable promptness and in accordance with schedule.
2. Review of separate item does not constitute review of an assembly in which item functions.
3. Affix stamp and initials or signature, and indicate requirements for resubmittal or acceptance of submittal.
4. Return submittals to the Contractor for distribution or for resubmission.

G. Schedule of Values and pay applications:
1. Submit typed schedule on State Form SC7.2; Contractor's standard form or media-driven printout will be considered on request.
2. Format: Table of Contents of this Project Manual.
3. Include in each line item a directly proportional amount of Contractor's overhead and profit.

H. Schedule of Submittals: The Contractor shall submit the submittals required by the specifications. The Contractor shall develop a submittal schedule that confirms the submittals and the time frame for review by the consultants.

I. Construction Schedule:
1. The Contractor shall submit a critical-path method (CPM) construction schedule prior to start of construction activities. The CPM schedule shall include notice to proceed, submittal activities, construction activities, change order work (when applicable), close-out, testing, demonstration, and acceptance. The CPM shall correlate specifically to the schedule of values line items and be cost loaded.

Float, slack time, or contingency within the schedule (i.e., the difference in time between the project's early completion date and the required contract completion date), and total float within the overall schedule, is not for the exclusive use of either the principal representative or the Contractor, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet contract milestones and the contract completion date.
The Contractor will be required to submit an as-built progress CPM schedule with each progress billing. This CPM schedule will be the basis for making progress payments. The level of detail and quantity of work activities in the CPM schedule should be negotiated with the principal representative prior to starting construction.

J. Progress Photos
1. The Contractor shall submit up to 12 - 3x4 inch progress photos with each progress payment. The photos should demonstrate the work in place and be dated with a short description of the photographed item.

K. Coordination Drawings:
1. The Contractor shall submit coordination drawings with all mechanical, electrical, fire protection, and building monitoring systems prior to the Consultant review of any shop drawings or submittals for work in those trades. Approval of required shops and submittals must be obtained prior to starting work, and must be obtained prior to approval of pay applications of the work. The drawings shall be created to include all trades on a particular level of the building on one drawing. Identify conflicts between the systems or between the systems and architectural elements such as ceiling heights, ceiling types, or walls. Conduit routing for electrical, mechanical, energy management system, and security trades shall be included. Identify potential solutions to the conflicts for the Consultant and Owner to review during the submittal process. Revise the coordination drawings to show any comments made during the submittal review process, and reissue for use by all affected trades, Owner and Consultant.
2. The Coordination drawings shall include sectional coordination documents. Identify elevations of systems A.F.F. (above finish floor) and component dimensions. Show elevations whenever component changes height.

L. Daily Reports
1. The contractor shall submit daily reports, due by 5 p.m. the following day. The report should include weather, equipment, manpower count, subcontractors on site, short description of work for that day, inspections, visitors, items that may affect progress or quality of project.

M. Request for Information (RFI):
1. The Contractor will be responsible for submitting RFIs on AIA form G716 or similar. The RFI should identify in writing any unclear, inconsistent, or conflicting item in the documents that could not be answered by thorough review by the Contractor or subcontractors. The RFI should include a description of the item and a proposed solution. The RFI should indicate schedule or cost impact, if any. Contractor shall be required to submit cost or schedule impact within seven days of receipt of the RFI response. Each RFI shall be numbered in sequence.

N. Weekly Logs:
1. The Contractor shall provide an updated RFI, change request, and submittal logs at weekly construction meetings. Contractor shall provide a 2-week detailed construction schedule at the weekly construction meeting.

PART 2 - MATERIALS

Not used.
PART 3 - EXECUTION

Not used.

END OF SECTION
PART 1 - GENERAL

1.01 SUPPLEMENTAL TESTING

If required, the following testing shall be performed at the expense of the contractor installing the material being tested:

A. Material Substitution: Any tests of basic material or fabrication equipment offered as a substitute for specified item on which a test may be required in order to prove its compliance with the specifications.

B. Mechanical/Electrical: Tests on mechanical and electrical systems required to insure their proper installation and operation.

C. Any test that fails shall be paid for by the installing contractor subject to the following conditions:
   1. Quantity and nature of tests will be determined by the Consultant.
   2. All test shall be done in the presence of the Owner or his representative.
   3. Proof of noncompliance will make the installing contractor liable for any corrective action which the Owner feels is prudent including complete removal and replacement of defective material.

Nothing contained herein is intended to imply that the installing contractor does not have the right to have tests performed on any material at any time for his own information and job control so long as the Consultant or Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

D. The Consultant shall determine the type and number of tests to be performed on the project.

1.02 TEST REPORTS

Reports of all tests made by testing laboratories shall be distributed by the testing laboratory as follows:
   1 copy - Contractor
   1 copy - Applicable supplier or subcontractor
   1 copy - Owner
   1 copy - Consultant
   Other copies - as directed

1.03 QUALITY CONTROL SYSTEM

A. General: The contractor shall establish a quality control system to perform sufficient inspection and tests of all items of work, including that of all subcontractors, to ensure conformance to the Contract Documents for materials, workmanship, construction, finish, functional performance and identification. This control shall be established for all construction except where the Contract Documents provide for specific compliance tests by testing laboratories or Consultants employed by the Owner.

The quality control system is the means by which the Contractor assures that construction complies with the requirements of the Contract Documents. Controls shall be adequate to cover all construction operations and should be keyed to the proposed construction schedule.
B. The Contractor shall designate a quality control representative on staff to review the work to insure compliance with the contract documents by weekly jobsite visits for observation. The designated employee shall not be involved in the performance of the work. The quality control representative shall review the work and make necessary corrections to bring the work into compliance prior to scheduling the Architect for the final punchlist review.

C. Records: The Contractor shall maintain correct records on an appropriate form for all inspections and tests performed, instruction received from the Owner and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken. The Contractor shall document inspections and tests as required by each Section of the Specifications.

1.04 INDEPENDENT TESTING AGENCY SERVICES

A. The Owner will employ and pay for the services of an independent Testing Agency to perform the Inspections, special inspections, tests and other services when required by sections of the specification. Services shall be performed in accordance with requirements of governing authorities and with specified standards.

1. Contractor shall cooperate with Testing Agency personnel and shall furnish tools, sample of materials, design mixes, equipment and assistance as requested.

2. Contractor shall provide and maintain, for the sole use of the Testing Agency, adequate facilities for the safe storage and proper curing of concrete testing cylinders on the project site for the first 24 hours after casting as required by ASTM C 31, Method of Making and Curing Concrete Test Specimens in the field.

3. Contractor shall notify Testing Agency sufficiently in advance of operations to allow for completion of initial tests and proper assignment of inspection personnel.

4. Contractor shall notify the testing agency sufficiently in advance of cancellation of required testing operations. The Contractor shall assume responsibility for costs incurred due to the failure to provide such notice.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS
   A. This section of the General Requirements outlines the basic requirements for temporary services, utilities, and facilities which will indirectly enable adequate construction progress and processes, and will accommodate other necessary activities at the project site except as otherwise indicated, the costs of providing and using temporary services are included in the Contract Sum.

1.03 QUALITY ASSURANCE
   A. Comply with governing regulations and utility company regulations and recommendations for the construction of temporary facilities, including but not necessarily limited to, code compliance, permits, inspections, testing, and health and safety compliance.

1.04 SITE CONDITIONS
   A. Provide Temporary facilities and services at the time first needed at the site and maintain, expand, and modify the facilities as needed throughout the construction period and do not remove until no longer needed.

PART 2 - EXECUTION

2.01 GENERAL
   A. Use qualified tradesmen for the installation of temporary facilities. Locate facilities where they will serve the total project construction work adequately and result in minimum interference with performance of the work. Relocate, modify, and extend facilities as required during the course of the work to properly accommodate the entire work of the project.

2.02 TEMPORARY FACILITIES
   A. Temporary Water: Connect to existing water source as designated by the Owner for construction operations.

   B. Temporary Telephone: Provide, maintain and pay for telephone service to field office at time of project mobilization. If a mobile phone is designated as the field office phone then it shall be a local number.

   C. Sanitary Facilities: Toilet rooms at the 2nd floor only may be used but must provide their own paper products and soap. Restrooms must be kept clean, not abused and not used to dispose of toxic/caustic materials, paint clean-up material, drywall patching debris, etc. Contractor assumes all liability in keeping the restrooms free of damage and will be assessed damages if not adhered to these conditions on usage.
D. Temporary Heat and Ventilation: Provide such OSHA approved heat and fuel, heating units, equipment as necessary to provide the required environmental conditions and to protect the work from damage due to cold. Maintain equipment in a clean, safe condition.

E. Fire Extinguisher:
   1. Except as otherwise indicated or required, comply with the applicable recommendations of NFPA No. 10 "Portable Fire Extinguisher" for each area of each construction activity whenever combustible materials, flammable liquids, and similar exposures to possible fires are present.
   2. Locate extinguisher where most convenient and effective for the intended purposes. Store combustible materials in recognized fire-safe locations and containers.

F. Protection
   1. Barricades, Warning Signs, and lights: Comply with recognized standards and code requirements for the erection of substantial and structurally adequate barricades wherever needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the general public where exposure exists of the hazard being protected. Provide lighting where appropriate and needed for the recognition of the facility, including flashing red lights where appropriate.

G. Temporary Enclosure: Wherever required, provide temporary enclosure of materials, equipment, work in progress, and completed portions of work, so as to afford protection for both the work and employees.

H. Miscellaneous Facilities:
   1. Provide ladders, ramps, and temporary stairs for access to all levels of the construction for general access by all trades. Individual contractors and subcontractors shall furnish their own stepladders, scaffolds, staging, work platforms, and other facilities for use of their workmen and as necessary for safety of all personnel.

I. Field Office:
   1. The Contractor shall provide and maintain a suitable temporary field office for his own use. Offices and all other temporary structures shall be removed from the site upon completion of the work. He may also choose, as an alternative, to maintain an office within the interior construction zone at the 1st or 2nd floor.
   2. Temporary structures or storage used for storage and offices for contractors shall be located on the site in an orderly manner as determined by the Owner.

2.03 OPERATIONS AND TERMINATIONS

A. Supervision: Enforce strict discipline in the use of temporary facilities at the project site. Limit availability of facilities to essential and intended uses, so as to minimize waste and possibility of abuses and the resulting unsanitary and hazardous or dangerous conditions.
B. Maintenance: Operate and maintain temporary facilities in good operating condition through the time of use and until removal is authorized. Protect from damage by freezing temperatures and similar elements at the site.

C. Termination and removal: At the time the need has ended for each temporary facility, or when it has been replaced by authorized use of a permanent facility, or at the time of Substantial completion, promptly remove the facility unless requested by the Consultant to be retained for a longer period of time. Complete or restore permanent work which may have been delayed or otherwise affected by the temporary facility. Replace work which cannot be satisfactorily restored. Except as otherwise indicated, the materials and equipment of temporary facilities remain the property of the contractors.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Products.
   2. Transportation and Handling.
   4. Manufacturer's Instructions.
   5. Product Options.
   6. Products List.
   7. Substitutions.

B. Related Sections:
   1. Section 01400 - Quality Control.
   2. Section 01730 - Operation and Maintenance Data.

1.02 QUALITY ASSURANCE

A. Conform to applicable specifications and standards.

B. Comply with size, make, type and quality specified, or as specifically approved in writing by the Consultant.

C. Manufactured and Fabricated Products:
   1. Two or more items of the same kind shall be identical, by the same manufacturer.
   2. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.04 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instruction, with seals and labels intact and legible.

B. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.05 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including one copy to the Consultant and one copy to the Contractor.
B. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.06 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Consultant will review requests for substitutions with reasonable promptness, and notify, by Addendum, of the decision to accept or reject the requested substitution.

1.07 PRODUCT LIST

A. Within 15 days after signing of agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.08 SUBSTITUTIONS

A. Will only be considered prior to bid or in the event that Equipment is not available.

1.09 SYSTEMS DEMONSTRATION

A. Prior to final inspection, demonstrate operation of each system to Consultant and Owner.

B. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
PART 1 - GENERAL

1.01 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

A. The Contractor shall comply with procedures stated in the General Conditions of the Contract for Notice of Completion, Final Inspection, Notice of Substantial Completion and Notice of Acceptance.

B. Should the Architect/Engineer or the Principle Representative determine that the work is not substantially complete, or the punch list items exceed 25, he will immediately notify the Contractor, in writing, stating reasons. After Contractor completes work, he shall resubmit certification and request for final inspection. The Contractor will be responsible for all costs beyond two Architect/Engineer walk-throughs.

C. Owner may occupy designated portions of the Project under provisions stated in the General Conditions of the Contract.

1.02 CLOSE-OUT FORMS

The Architect/Engineer will complete the Notice of Approval of Beneficial Occupancy, Closing-out Checklist and Contract Close-out forms and forward them to the Contractor. Comply with procedures stated in General Conditions of the Contract.

1.03 FINAL SETTLEMENT AND PAYMENT

A. Contractor shall comply with procedures stated in the General Conditions of the Contract before final settlement and payment are made.

B. The Contractor shall also submit the following prior to the final application for payment:
   1. Contractor’s Affidavit of Payment of Debit and Claims: AIA G706.
   2. Contractor’s Affidavit of Release of Liens (claims): AIA G706A, with:
      a. Consent of Surety to final payment: AIA G707
      b. Contractor’s release of waivers of claims.
      c. Separate release of waivers of claims for subcontractors, suppliers and others with claim rights, against property of owner, together with list of those parties.

1.04 GUARANTEE INSPECTION

A. The Contractor shall comply with procedures stated in the General Conditions of the Contract for Guarantee Inspections after completion of the work.

1.05 WARRANTIES AND SPECIAL GUARANTEES

The Contractor shall comply with procedures and criteria outlined in the General Conditions of the Contract for all warranties and special guarantees of the work.

1.06 OPERATING AND MAINTENANCE DATA

A. Refer to Section 01730 - Operating and Maintenance.

B. Mechanical - By Mechanical Contractor: See Division 15.
C. Electrical - By Electrical Contractor: See Division 16.

1.07 DEMONSTRATIONS

A. Refer to Section 01730 - Operating and Maintenance

B. Mechanical - By Mechanical Contractor: See Division 15

C. Electrical - By Electrical Contractor: See Division 16.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

B. At the completion of the project, all loose keys for hose bibs; adjustment keys and wrenches for door closers and panic hardware; and keys for electric switches, electrical panels, etc., shall be accounted for by the Contractor and turned over to the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 CLEANING

A. Clean-up During Construction: Each contractor shall keep the building and premises free from all surplus material, waste material, dirt and rubbish caused by his employees or work, and at the completion of his work he shall remove all such surplus material, waste material, dirt and rubbish, as well as his tools, equipment and scaffolding, and shall leave his work clean and spotless, unless more exact requirements are specified. In case of dispute, the owner may remove all such items and charge the cost of such removal to the contractor.

Each sub-contractor shall perform his clean-up daily and shall transport his rubbish to an on-site location designated by the Contractor who will arrange for its removal.

B. Cleaners: With the exception of clean-up of the site and cleaning specifically assigned to Contractors under various sections of the specifications, all final clean-up of exterior and interior of the building shall be done by professional cleaners.

C. Final Clean-up:
   1. Exterior: In addition to items specified below, any new surfaces on exterior, concrete, metal, etc., shall be carefully and thoroughly cleaned.
   2. Glass: Both sides of all glass in work areas shall be carefully and thoroughly cleaned by professional window cleaners and left absolutely clean and free from paint, grease, dirt, etc.
   3. Hardware: Clean and polish all hardware and leave clean and free from paint, grease, dirt, etc.
   4. Plumbing: Clean and polish all plumbing fixtures, fittings, and exposed plated piping. Leave clean and free from paint, grease, dirt, etc. Remove all labels.
   5. Electrical: Clean and polish all electric fixtures, including glassware, switch plates, etc. and leave clean and free from paint, grease, dirt, etc.
   6. Equipment: Carefully and thoroughly clean all items of equipment, mechanical, electrical, cabinets, ductwork, etc.
   7. Floors: Thoroughly clean all floors. Vacuum and clean carpeting. Shampooing of pre-existing carpet is required once project is complete. Contractor is responsible for this.
      a. Contractors are responsible for cleaning (stripping floors if necessary) then applying the required two coats of sealer and three coats of finish before releasing the building for occupancy. Facilities Management will provide a contact person for help concerning campus standards free of charge. Or Custodial floor care services may be sub-contracted out through Facilities Management's work order system.
      b. Facilities Management Approved Sealers and Finishes for Vinyl Tile Flooring:

CU requires floor care products to be from the same product line. (Different brands may interact disastrously).

All of these products may be ordered through Construction Stores, but these products not stocked at Stores, please place orders at least two weeks in advance.
Campus safety standards require at least TWO (2) coats of Sealer be applied to a cleaned floor, and at least THREE (3) coats of Finish must be applied on top of the sealer.

c. Floor Cleaning Procedures:
   1. Sweep floor clean of debris
   2. Cord off area if necessary
   3. Put up Caution signs
   4. Mix Stripper or Cleaning solution according to label
   5. Apply solution to floor
   6. Start setting up equipment
   7. Place RED abrasive pad on buffer (buffer less than 300 rpms)
   8. Begin stripping or cleaning floor working with buffer moving it side to side across the floor.
   9. Use HEPA filtered water vacuum to begin to suck up slurry*  
      *use of HEPA filtered water vacuum is required on existing floor tile which contains asbestos.
   10. Apply additional coats of water and re-vacuum up floor
   11. Mop floor with clean water, change rinse water often
   12. Mop floor a second time
   13. Mop floor to dry completely
   14. Clean up equipment
   15. Wash red pad with clean water.

d. Sealing Procedures:
   1. Using a new mop head or clean wax mop and clean bucket, apply first coat of approved sealer to floor
   2. Allow floor to dry completely (at least 20 minutes)
   3. Apply second coat of sealer
   4. Allow floor to dry

e. Finishing (Waxing) Procedures:
   1. Using a clean wax mop and bucket apply first coat of approved finish (wax)
   2. Allow floor to dry completely (at least 20 minutes)
   3. Apply second coat of finish (wax)
   4. Allow floor to dry completely (at least 20 minutes)
   5. Apply third coat of finish (wax)
   6. Allow floor to dry completely (at least 30 minutes)
   7. Wash mop and bucket with clean water
   8. If floor is dry - remove caution signs and open area up
f. Burnishing Procedures:
The next working day
1. Sweep floor clean of debris
2. Spot mop floor to remove spots and dirt
3. Set up High Speed Burnisher to make for a safe environment
4. Start Burnishing. Walk forward in a straight line
5. At end of row, turn around and start forward again
6. Repeat steps 5 & 6 until finished
7. Clean up equipment and pad.

E. Completion: The entire work inside and out, and the entire premises shall be in first-class, clean condition upon completion before being accepted by the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. This section describes the definitions, recording and maintenance requirements and the submittal requirements for record documents.

1.02 DEFINITIONS

A. The Project Record Documents are intended to indicate all changes and deviations from the original contract documents and permanently record the "as-built" condition of material, equipment and structure. The project record documents shall include the contract drawings, project manual, addenda, change orders, modifications and clarifications, field directives, approved shop drawings, approved product data, manufacturer’s certificates and project test results.

1.03 SUBMITTALS

A. Submit the project record documents in conformance with Section 01700 and prior to the final applications for payment. The final application for payment will not be approved prior to the submittal of record documents.

1.04 QUALITY ASSURANCE

A. The project record documents shall be updated at a minimum on a weekly basis and shall be readily available for inspection by the owner and consultants. Maintain a separate set of complete documents for exclusive use of record documents and protect the documents from damage in a clean, dry location. Note: Progress applications for payment will not be approved if record documents are not current.

B. The record documents shall contain a clear, legible record of all detail and dimensional changes and locate all concealed work including, but not limited to:
   1. Interior and Exterior Utilities
   2. Valves
   3. Dampers
   4. Controls
   5. Junction Boxes
   6. Clean-outs
   7. Access Doors

C. The project manual (specifications) shall indicate all manufacturers’ products complete with catalogue number and trade name of products installed. All changes and corrections to the project manual shall be clearly indicated.

END OF SECTION
Part 1 - General

1.01 Description of Work

A. Compile product data and related information appropriate for the University of Colorado’s maintenance and operation of products furnished.

B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of specifications.

C. Instruct the University of Colorado, Facilities Management personnel in the maintenance of products and in the operation of equipment and systems.

1.02 Quality Assurance

A. Preparation of data shall be done by personnel:
   1. Trained and experienced in maintenance and operation of the described products.
   2. Completely familiar with requirements of this section.
   3. Skilled as a technical writer to the extent required to communicate essential data.
   4. Skilled as a draftsman competent to prepare required drawings.

1.03 Submittals

A. Prepare data in the form of an instructional manual for use by the University of Colorado, Facilities Management personnel. Quantities are listed in Part 1.07.

B. Format:
   1. Submit electronically in Portable Document Format (PDF) format as one document, OCR (Optical Character Recognition) searchable, bookmarked according to the Construction Specifications Institute (CSI) standards.
   2. Title shall be “Operating and Maintenance Instructions”, and shall include:
      a. Name of project and date of completion (month and year).
      b. Project number.
      c. Identify of general subject matter covered in the manual (e.g., Architectural, Mechanical, Electrical and/or Civil).

1.04 Content of Manual

A. An electronically-written table of contents shall be provided for each volume, arranged according to CSI standards.
   Include the following:
   1. Name of responsible installing principal contractor, address, and telephone number.
   2. A list of each product being included, indexed to the content of the volume.
   3. List with each product, the name, address, and telephone number of:
      a. Maintenance contractor, as appropriate.
      b. Identity of the area of responsibility of each.
   4. Identify each product by product name and other identifying symbols.
B. Product Data:
1. Local source of supply for parts and replacement.
2. Include only those sheets that are pertinent to the specific product, with the following information.
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete references to inapplicable information.

C. Drawings:
1. Supplement product data with drawings as necessary to clearly illustrate:
   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
2. Coordinate drawings with information in project record drawings to ensure correct illustration of completed installation.
3. Do not use project record drawings as maintenance drawings.

D. Provide written text, as required, to supplement product data for the particular installation:
1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.

E. Provide a copy of each warranty, bond, and service contract issued. Provide information sheets for the University of Colorado, Facilities Management's personnel and give:
1. Proper procedures in the event of failure.
2. Instances that might affect the validity of warranties or bonds.

1.05 MANUALS FOR ARCHITECTURAL MATERIAL AND FINISHES

A. Submit copies (per schedule shown in paragraph 1.07) of complete manual in final form.

B. Content for architectural products include applied materials and finishes.
1. Manufacturer's data, giving full information on products.
   a. Catalog number, size, and composition.
   b. Color and texture designations.
   c. Information required for reordering special manufactured products.
2. Instructions for care and maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to the product.
   c. Recommended schedule for cleaning and maintenance.

C. Content for moisture-protection and weather-exposed products:
1. Provide manufacturer's data, giving fully information on products.
   a. Applicable standards
   b. Chemical composition
   c. Details of installation
2. Provide instructions for inspection, maintenance, and repair.
1.06 MANUAL FOR NON-ARCHITECTURAL EQUIPMENT AND SYSTEMS

A. Submit copies (per schedule) of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate shall contain:
   1. Description of unit and component parts (Consultant-approved submittals).
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and Commercial number of all replaceable parts.
   2. Operating Procedures:
      a. Start-up, break-in, routine, and normal operating instructions.
      b. Regulation, control, stopping, shutdown, and emergency instructions.
      c. Summer and winter operating instructions.
      d. Special operating instructions.
   3. Maintenance Procedures:
      a. Routine operations.
      c. Disassembly, repair, and reassembly.
      d. Alignment, adjustment, and checking.
   4. Servicing and Lubrication Schedule, including a list of lubricants required.
   5. Manufacturer's operating and maintenance instructions.
   6. Description of sequence of operation by control manufacturer.
   7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance and replacement.
      a. Predicted life of parts subject to wear.
      b. Items recommended to be stocked as spare parts.
   8. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Content for each electric and electronic system, as appropriate, shall contain:
   1. Description of system and component parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, and tests.
      c. Complete nomenclature and Commercial number of replaceable parts.
   2. Operating Procedures:
      a. Routing and normal operating instructions.
      b. Sequences required.
      c. Special operating instructions.
   3. Maintenance Procedures:
      a. Routing operations.
      c. Disassembly, repair, and reassembly.
      d. Adjustment and checking.
      e. Manufacturer's printed operating and maintenance instructions.
      f. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of the University of Colorado, Facilities Management's personnel.
1.07 OPERATION & MAINTENANCE MANUAL

A. Operations and Maintenance Manuals – all disciplines – submit electronically in Portable Document Format (PDF) format as one document, OCR (Optical Character Recognition) searchable, bookmarked according to the Construction Specifications Institute (CSI) standards.

1.08 SUBMITTAL SCHEDULE

A. Submit one electronic copy to the Consultants and one to the University of draft of proposed formats and outlines of contents upon completion of the submittal process. The Consultants and the University staff will review the draft and will submit comments through the consultants.

B. Submit electronic copies of complete manual(s) in final form 15 days prior to final inspection or acceptance. Comments will be submitted after final inspection.

C. Submit specified number of CDs or DVDs of approved data in final form prior to acceptance.

1.09 INSTRUCTION OF UNIVERSITY OF COLORADO, FACILITIES MANAGEMENT PERSONNEL

A. Fully instruct the University of Colorado, Facilities Management personnel's designated operating and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment, and systems as required elsewhere in the specification.

B. Operating and Maintenance manual may be required as the basis of instruction.

PART 2 - MATERIAL

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Prepare commissioning process based on the Commissioning Checklists found in the UCB Standards website:

http://fm.colorado.edu/construction/standards/

B. Coordinate the requirements of Project Closeout and Operating and maintenance sections that are part of Division 1.

C. Schedule the required commissioning activities with the University of Colorado Facilities Department and their consultants at least 72 hours prior to conducting Commissioning activities.

PART 2 - MATERIALS

Not Used.

PART 3 - EXECUTION

NOT USED

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Schedule: Submit schedule indication proposed methods and sequence of operations for selective demolition work.

C. Inventory:
   1. Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
   2. Submit a list of items that have been removed and salvaged.

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that
recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

E. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Occupancy:
1. University personnel will be continuously occupying areas of the building immediately adjacent to areas of selective demolition. Verify with CU Project Manager whether building will be occupied or vacated during expected Work activities.
2. Conduct selective demolition work in manner that will minimize the need for disruption of normal operations if building remains occupied.
3. Provide a minimum of 72 hours advance notice of demolition activities and utility outages.
   a. Outages of services require a 10 day advance notice given to the CU Project Manager to coordinate with users.

B. Condition of Structures:
1. The University assumes no responsibility for actual condition of items or structures to be demolished.
2. Conditions existing at time of commencement of contract will be maintained in-so-far as practical. A copy of the environmental site assessment will be available for inspections at the CU Project Manager's office.

C. Protection of Persons and Property: Provide temporary barricades, traffic control, and other forms of protection as require. Contractor to comply fully with OSHA requirements.

D. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Clean-up is required daily as work progresses.

E. Explosives: Use of explosives will not be permitted.

F. Utility Services:
1. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
2. Coordinate utility outages with Department of Facilities Management, affected utility companies, and affected users.

G. Environmental Controls:
1. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and
dirt rising and scattering in area to lowest practical level. Comply with the Department of
Environmental Health and Safety requirements pertaining to environmental protection.
Comply with Colorado Department of Health requirements regarding debris control.
2. Keep dust and dirt from migrating to occupied building areas.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or
damaged during selective demolition, by methods and with materials so as not to void existing
warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that
existing system has been inspected and warranty remains in effect. Submit documentation at
Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before
beginning selective demolition. Comply with hauling and disposal regulations of authorities
having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

2.2 SALVAGE

A. The Owner reserves first salvage rights including:
   1. Construction materials and products.
   2. Mechanical, electrical equipment and components.

B. The Contractor shall notify the Owner for review of materials to be stored or selected for
salvage.

C. Coordinate with the Department of Facilities Management.
   1. Items indicated to be removed but of salvageable value to Contractor may be removed in
      a timely manner from structure as work progresses, if such items are not claimed by the
      Owner.

D. Transport salvaged items from site as they are removed.

E. Storage or sale of removed items on site will not be permitted.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to CU Project Manager.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

D. Cover and protect furniture, equipment and fixtures, if not removed by Owner.

E. Erect and maintain dust-proof and weatherproof partitions and closures as required.
F. Locate, identify, stub-off and disconnect utility services that are indicated to be removed.

G. Request inspection by Department of Facilities Management and applicable utility companies:
   1. When utilities are uncovered.
   2. Prior to covering-up or concealing utilities.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Perform selective demolition work in a systematic manner.
   1. Demolish concrete and masonry in small, manageable sections. Do not overload structure with debris. Cut concrete and masonry using power-driven masonry saw or hand tools; do not use power-driven impact tools in buildings.
   2. Locate demolition equipment throughout structure to avoid imposing excessive loads on supporting walls, floors or framing.
   3. Construct chutes as required to conduct debris safely to grade disposal areas. Comply with Environmental Health and Safety and Colorado Department of Health dust control and safety requirements.
   4. Do not cut or alter any structural member without authorization of the Architect.

3.5 REUSED MATERIALS

A. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
SELECTIVE STRUCTURE DEMOLITION

B. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by CU Project Manager.
   5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from demolition operations from building site and off the campus.

B. Under no circumstances should the University’s dumpsters be used for disposal of demolished materials.

C. Burning of removed materials is not permitted on Project Site.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for ceiling-hung toilet compartments.
   2. Steel framing and supports for countertops.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.

B. Products furnished, but not installed under this Section: Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 REFERENCES

A. Campus Open Space Development Plan, University of Colorado, Boulder (COSDP).


1.3 DEFINITIONS

A. Metal Fabrications:
   1. Synonymous with miscellaneous metals.
   2. Metal fabrications for items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

1.4 SUBMITTALS

A. Product Data: Submit product data for manufacturer’s stock items.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections using standard AWS welding symbols. Show anchorage and accessory items.

   1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.
D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

B. Engineering Qualifications: Professional Engineer licensed to practice in the State of Colorado and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch (14.3-mm-) wide slotted holes in webs at 2 inches (51 mm) o.c.
   1. Width of Channels: 1-5/8 inches (41 mm).
   2. Depth of Channels: 1-5/8 inches (41 mm).
   3. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
   4. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.
   5. Finish: Hot-dip galvanized after fabrication.


G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 ALUMINUM


C. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

D. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

2.4 PAINT

A. Clean ferrous metal of scale, rust, oil, moisture, and dirt before applying paint.
   1. Paint all metal black unless otherwise noted.

B. Apply one shop coat of Tnemec 10-99 long-oil alkyd primer or approved substitute to ferrous metals after fabrication. Apply two shop coats to ferrous metals that will be inaccessible after erection.
C. Painting specified here does not count as a coat for finish painting.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with “Carboline-Galvanox (Basis-of-Design).

E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

F. Omit shop painting on surfaces embedded in concrete or requiring field welding.

2.5 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.


E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).


I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

   1. Material:
      a. Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
      b. Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.6 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
2.7  FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch (12.7-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6.4-mm) top plates.

E. Galvanize miscellaneous framing and supports where indicated.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim.

2.10 FINISHES, GENERAL

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.
2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123, for galvanizing steel and iron products.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Shop primer shall be compatible with the paint systems specified in Division 09 painting Sections.

2.12 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous rough carpentry includes carpentry work not specified as part of other Sections and which is generally not exposed to normal view (concealed).
2. Rooftop equipment bases and support curbs.
3. Wood blocking and nailers.
4. Wood furring and grounds.
5. Wood sleepers.

B. Related requirements include Division 06 finish carpentry Sections for nonstructural carpentry items exposed to view and not specified in another Section.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Wood Treatment Data:

   a. Submit chemical treatment manufacturer’s instructions for handling, storing, installation, and finishing of treated materials.

   b. Preservative Treatment:

      1) For each type specified, include certification by testing plant stating preservative solutions and pressure process used, net amount of preservative retained, and conformance with applicable standards.

      2) For water-borne preservatives, certify that moisture content of materials was reduced to a maximum of 19% after treatment and prior to shipping to Project Site.

   c. Fire-Retardant Treatment:

      1) Include certification by treating plant that treatment material complies with specified standards, and governing authorities.

      2) Include materials test reports from qualified testing laboratory indicating and interpreting test results relative to compliance of fire-retardant treated wood products with requirements indicated.

B. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

B. Standards:
   1. Lumber: Comply with PS 20, WWPA Grading Rules and other grading rules as specified.
   2. Plywood: Comply with PS 1, “U.S. Project Standard for Construction and Industrial Plywood.”
   4. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency, except omit markings from surfaces to be exposed with transparent finish or without finish.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment:
   1. Where lumber or plywood is indicated as “Treated," or is specified herein to be treated, comply with applicable requirements of AWPA Standard C2 for lumber and C9 for plywood.
   2. Mark each treated item with the AWPB or SPIB Quality Mark.
   3. Wood nailers for roofing shall be weather resistant to comply with roof manufacturer’s standards for Wolmanized or equal treatment.
   4. Wood for nailers shall be #2 or better.
   5. Creosote and asphaltic preservatives are not acceptable.
   6. Pressure-Treatment for Above-Ground Items: Water-borne preservatives complying with AWPB LP-2. After treatment, rack dry or kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following:
      a. Wood cants, nailers, burs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
      b. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
   7. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
   8. Do not treat any wood to receive fire-retardant treatment.
B. Kiln-dry lumber after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant Treatment:
   1. Where fire-retardant lumber or plywood is specified, required by Code, or otherwise indicated, comply with AWPA C20 Standard for lumber and C27 for plywood. Provide Type A treatment for interior and Exterior Type for exterior uses, with fire-retardant chemicals to achieve a flame-spread rating of not more than 25 when tested in accordance with UL Test 723 or ASTM E 84.
      a. Provide UL label on each piece of fire-retardant treated lumber or plywood.
      b. Rack dry or link-dry treated items to a maximum moisture content of 15%.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Furring.
   5. Grounds.

B. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 2 grade; SPIB.
   2. Eastern softwoods, No. 2 Common grade; NELMA.
   3. Northern species, No. 2 Common grade; NLGA.
   4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

E. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

2.6 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.


1. Use for interior locations unless otherwise indicated.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.
2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

C. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer’s written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

D. Provide 2 inch nominal wood blocking in metal stud framing to support toilet accessories, grab bars, railings, fixtures, wall mounted casework and equipment, wall mounted door stops and other similar items.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size (19-by-63-mm actual-size) furring horizontally and vertically at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size (19-by-38-mm actual-size) furring vertically at 16 inches (406 mm) o.c.
3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Interior standing and running trim.
2. Shelving.
3. Custom millwork.
4. Custom cabinets.
5. Cabinet hardware.
7. Shop finishing of interior woodwork.

B. Related Sections:
1. Division 06 Section “Miscellaneous Rough Carpentry.”
2. Division 08 Section “Door Hardware.”

1.2 REFERENCES

B. Uniform Federal Accessibility Standards (UFAS).

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
C. Sample:
   1. Lumber with or for transparent finish, not less than 50 sq. in. (300 sq. cm), for each species and cut, finished on 1 side and 1 edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
3. Veneer-faced panel products with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
4. Plastic laminates, 3 samples of 2 inches by 3 inches, for each species, color, pattern, and surface finish.
5. Thermoset decorative-panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
6. Solid-surfacing materials, 6 inches (150 mm) square.
7. Corner pieces as follows:
   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
   b. Miter joints for standing trim.
8. Exposed cabinet hardware and accessories, one unit for each type and finish.

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

F. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI’s Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI’s Quality Certification Program.

C. Quality Standard: Except as otherwise shown or specified, comply with specified provisions of the Architectural Woodwork Institute (AWI) “Quality Standards”. In event of dispute as to performance under AWI standards, Owner may call upon AWI for an inspection and report by AWI Quality Certification Program. All parties agree to abide by AWI decisions. Costs for this service will be paid by Owner unless AWI determines that specified standards have not been met, in which case costs will be paid by Contractor.

1. Wood Casework: AWI Section 400, Custom Grade. Premium grade will be considered only in specific applications with the recommendation of the design consultant and with the concurrence of the University.
2. Standing and Running Trim: AWI Section 300, Custom Grade. Custom grade will be considered for special application areas with the specific consent of the University.
3. Shelving: AWI Section 600, Custom Grade.
4. Miscellaneous Work: AWI Section 700, Custom Grade.
5. Shop Finishing: AWI Section 1500, Custom Grade.
6. Plastic Laminate Casework and Countertops: AWI Section 400, Custom Grade.
7. Wood Paneling: AWI Sections 200 and 500, Custom Grade. Premium recommendation of the design consultant and with the concurrence of the University.
8. Installation: AWI Section 1700, Custom Grade.
9. For remodeling work, match existing, adjacent woodwork in color, species and grade quality.
D. Grading and Marking: Lumber shall be marked on each piece, location on surfaces which will not be exposed after installation. Grade marks to be of the association under whose rules it is graded. Bundle marking or Certificate of Inspection issued by the association will be permitted in lieu of marking each individual piece.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in “Project Conditions” Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 8 “Section 08710 - Door Hardware (Scheduled by Describing Products)” to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. As indicated in other Part 2 Articles below.
2. Provisions indicated in Division 01 Section “Materials and Equipment.”
2.2 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Veneers:
   1. Plain sliced, narrow heart, Architectural panel grade veneer.
      a. Matching between adjacent veneers: Bookmatch.
      b. Matching between individual panel faces: Balanced to panel.
      c. Matching or adjacent panels: Sequenced.
   2. Species: As scheduled.
      a. Sapwood is not acceptable.

C. Hardwood Lumber:
   1. Graded in accordance with AWI grading standards for Premium Grade Solid Stock.
   2. Species: As selected by Design Consultant.
      a. Sapwood is not acceptable.

D. Hardwood Plywood:
   1. Comply with PS 51, Premium Grade hardwood face veneers.
   2. Face and back veneers grade selected in accordance with AWI Standards for Premium Grade, select for color.
   3. Species: As selected by Design Consultant.
      a. Sapwood is not acceptable.

E. Particleboard: Medium density (45lbs/cu. ft. minimum) board fabricated from wood chips and phenolic resin binders, compressed board, ¾ inch thickness unless otherwise indicated complying with ANSI A208.1, Grade 1-M-3.

F. Hardboard: PS 58, Class 1 (tempered), smooth one side or both sides where indicated, ¼ inch thickness unless as otherwise indicated.

G. Solid Stock: Selected for color and graining. Unless otherwise shown, provide solid materials of the same species as adjacent or abutting exposed, transparent finished veneer.

H. MDO Plywood: Medium Density Overlay (MDO) plastic faced plywood.
   1. Finish: One face finish, smooth paint grade.

I. Plastic Laminates:
   1. Available Manufacturers:
      a. Formica Corporation.
      b. Nevamar.
      c. Wilson Art.
   2. Laminated Countertops and Edges:
      a. All custom countertops (vanities and other tops for mill-built cabinets, etc.) shall be pressure laminate.
      b. Selection will be made from all available manufacturer’s patterns. Wood grains, solid colors and standard finishes.
c. Countertops: 1 inch particleboard with 1/2 inch overhang. Finish front and sides with the countertop materials.
d. Backsplashes shall be 3/4 inch thick, finished with high pressure laminated materials on the front, top edge and side edges.

3. Plastic Laminate Applications:
   a. Plastic Laminate for Horizontal Surfaces: Type 2, 0.050 inch thick, General-Purpose Type (high-pressure).
   b. Plastic Laminate for Post-Forming: Type 3, 0.042 inch thick, Post-Forming Type (high pressure).
   c. Plastic Laminate for Cabinet Linings: 0.020 inch thick, Lining Type (high pressure). At surfaces where high pressure balancing sheet is not required, 0.020 inch thick low pressure melamine may be used.
   d. Plastic Laminate for Concealed Panel Backing: 0.020 inch thick, Backer-Type (high pressure).

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Nails:
   1. Do not use nails for gluing pressure.
   2. Nails may be used only for temporary, concealed anchorage.

D. Wood Screws:

E. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
   1. Adhesive for plastic laminate and hardwood veneer shall conform to the recommendations of AWI 100-G-12.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: At the time lumber and other materials are delivered and when installed in the Work, their moisture content shall be 19 percent maximum for treated and untreated lumber 2 inches or less in thickness.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species and Cut: Match building standard, plain sawn.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

E. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Premium.

B. Wood Species: Any closed-grain hardwood.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.7 SHELVING

A. Grade: Premium.

B. Shelf Material: 3/4-inch (19-mm) thermoset decorative panel with solid-lumber edge.

C. Cleats: 3/4-inch (19-mm) thermoset decorative panel.
D. Wood Species:
   2. Suspended Shelving: Medium-density fiberboard.

E. Wall Mounted Shelving Hardware: Heavy-duty standards and brackets.

F. Suspended Shelving Hardware:
   1. Heavy-duty metal rod for all-thread attachment.
   2. Uni-strut frame.

2.8 CUSTOM CABINETS

A. Grade: Premium.

B. Cabinet Surfacing:
   1. Interior sides of particleboard core doors shall be faced with balancing sheets.
   2. Cabinet doors and drawer edges shall be edged to match veneer.

C. Frame cabinets in a substantial manner with all necessary blocking, braces, bottoms, etc.
   1. Cross supports under countertops shall be sufficiently heavy to carry a 200 pound weight without sagging.
   2. Frame shall be pinned, glued, or screwed together in accordance with AWI Standards indicated.

D. Cabinet backs not exposed to view may be hardboard, as decided by University Representative.

2.9 CABINET HARDWARE

A. 3/4 Inch Doors: Invisible type, self closing overlay 120 degree opening similar to Grass America, Inc. model # VS8-3800 with 2 hinges per door. Anchor with 1000 Series baseplate and 5.2 mm sleeve screws.
   1. Other Approved Manufacturers:
      a. Prameta.
      b. Hafele.

B. Adjustable Shelf Standards:
   1. Knape and Vogt No. 255 with No. 256 supports.
   2. Predrilled holes at 32 mm o.c. with 2 pin self-locking nylon clips capable of supporting a minimum of 250 lbs. each. Provide four per shelf.

C. Drawer Slides:
   1. Typical Drawer Slides:
      a. Salice Series 200 Self closing/Free Swing 120 Degree hinge.
      b. Blum No. 230E, 100 pound capacity.
   2. File Drawer and Lateral File Drawer Slide:
      a. Accuride No. 3832, 100 pound capacity.
      b. Blum No. 430E, 100 pound capacity.
D. Cabinet Locks:
   1. Provide cabinet locks for doors and drawers as required by the Owner.
   2. Locks shall accept cylinders keyed to master key system.

2.10 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 9 painting Sections for finishing architectural woodwork not indicated to be shop finished.

C. Shop Priming: Shop apply the prime coat including backpriming, if any, for items specified to be field finished. Refer to Division 9 painting Sections for material and application requirements.

D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

2.11 FACTORY FINISHING

A. Natural Finish: AWI Finish System No. TR-4 Catalyzed Vinyl (Custom Grade).

   1. Filler (For Open Grain Woods: Filled Finish).
   2. Washcoat.
   3. Stain (To be selected by Architect).
   4. Sealer.
   5. Sand (220 grit stearated paper).
   6. Topcoat.
   7. Sand (220 grit sandpaper).
   8. Topcoat.

B. Waterproof Finish: AWI Finish System No. TR-6 Catalyzed Polyurethane (Premium Grade).

   1. Filler (For Open Grain Woods: Filled Finish) used only in tabletops.
   2. Washcoat.
   3. Stain.
   4. Sealer.
   5. Sand (220 grit stearated paper).
   6. Topcoat.
   7. Sand (220 grit sandpaper).
   8. Topcoat.

C. Paint: Refer to Division 09 Section “Interior Painting.”
2.12 FABRICATION

A. Workmanship shall equal in all respect to the standards of Premium quality furniture work as described by AWI. Perform all work by qualified and fully competent workmen.

B. Allow sufficient additional material to permit.
   1. Accurate scribing to walls and related work.
   2. Provide for shrinkage that may develop after installation.
   3. Scribe casework edge panels to walls.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify all dimensions in the field and take particular care to align with all joints and recesses, where required, with the building module lines.

B. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Match color and grain pattern across joints.
3. Install trim after gypsum board joint-finishing operations are completed.
4. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes.
5. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

G. Plastic Laminate Joints:
1. Staggered from substrate joints.
2. Hair-line, flush butt joints.
3. Number of joints shall be kept to a minimum.

H. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless otherwise indicated
1. Install flush paneling with no more than 1/16 inch in 96-inch (1.5 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane..

I. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

J. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

K. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

L. Refer to Division 09 painting Sections for final finishing of installed architectural woodwork.

3.3 APPLICATION OF HARDWARE

A. Receive, store and be responsible for all finished hardware.

B. Apply hardware in accordance with manufacturer’s instructions and UFAS requirements.

C. Location of hardware in connection with doors shall be as follows:
1. Center door levers 38 inches above finished floor.
2. Space center hinges equal distance between top and bottom hinges.

D. Fit hardware for drawers and doors:
1. To permit items to close without forcing or rattling.
2. Carefully fit and adjust as required to ensure smooth and noiseless operation.
3. Remove and replace hardware items necessary to prevent damage, soiling and staining during finishing operations.

3.4 APPLICATION OF FINISHES

A. Visual Tests Applicable to Exposed Surfaces:
1. Variations in Color: Must match approved Samples.
2. Runs: None.
3. Sags: None.
4. Finish Sanding Scratches: None.
5. Blistering: None.
6. Glue Spots: None.
7. Checking, Crazing, or Cracking: None.

3.5 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Blanket batt insulation.
   2. Rigid board insulation.
   3. Sound-rating requirements.

B. Related Section includes Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.2 SUBMITTALS

A. Provide manufacturer’s written certification that insulation products meet specified requirements for the use intended.

B. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Performance Limitations:
   1. Certain cellular plastics used in building construction, though tested in conformance under ASTM and NFPA criteria, have been considered by the Federal Trade Commission as performing differently under actual fire conditions than under test conditions. Such products, if allowed to remain exposed or unprotected, may produce rapid flame spread, quick flashover, toxic or flammable gases, dense smoke and intense and immediate heat and may present a serious fire hazard. Architects are cautioned to thoroughly investigate these materials and their installation prior to specifying insulation products.
   2. Materials used to insulate and fireproof buildings shall contain no asbestos.

C. Thermal Conductivity:
   1. Insulation values are for a thermal conductivity (K-value) measured at 75 degrees F.
   2. Adjust thicknesses as required when using material having a different thermal conductivity or tested at a different temperature.
   3. Where insulation is specified to have a specific “R” value, furnish manufacturer’s standard thickness required to equal or exceed the specified value.
   4. Insulation “R” Values:
      a. Walls:
         1) R = 19 minimum above grade.
         2) R = 10 below grade.
b. Roofing:  $R = 30$ average.
c. Soffit:  $R = 19$ minimum.
d. Above-Grade Slabs over Unheated Spaces:  $R = 19$ minimum.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver plastic insulation materials to the Project site prior to time of installation. Protect at all times against ignition. Complete the installation and concealment of plastic materials as rapidly at possible.

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 BLANKET BATT INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Certain Teed Corp.
   2. Owens-Corning Fiberglass.

B. Foil-Faced Batt Insulation: Resilient glass fibers bonded with thermosetting resin to foil facing.
   1. Unfaced or kraft-paper faced batt insulation is not acceptable.
   2. Batts shall have a minimum R-Value of 3.0 per inch of insulation thickness.
   3. Vapor Transmission: Not more than 0.1 perms.
   4. Comply with ASTM C 665, Type III.
   5. Install foil-faced insulation in such a way to ensure integrity of vapor barrier. Tape all joints, penetrations, and at top and bottom of walls.
   6. Where not covered with a 15 minute thermal barrier, provide batts, including vapor barrier, not exceeding a flame spread of 25 or smoke developed of 50 per ASTM E 84; and rated noncombustible per SATM E 136.

2.2 RIGID BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amoco.
   2. Celotex Corp.
   3. Dow Chemical Co.
   5. U.C. Industries.
B. Polyisocyanurate, Foil-Faced, Reinforced with Chopped Fiberglass: FS HH-I-1972, Class 2, with an aged R-Value of 6.38 per inch.
   1. Closed cell extruded polystyrene is not acceptable for it’s outgassing of acrid odor properties.

2.3 SOUND-RATING REQUIREMENTS

A. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) scheduled or indicated in accordance with ASTM E 90.
   1. STC Rating: Minimum 49.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Install thermal or sound control insulation where indicated by friction fitting between studs, filling entire cavity and completely surrounding electrical equipment.

E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

F. All exposed exterior building columns and beams shall be insulated from the interior at the same R = 19 rating as for walls.

G. Insulate around support and support cross-beams.
3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Roof curbs.
   2. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS
A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.3 SUBMITTALS
A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Required clearances.
E. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.4 COORDINATION
A. Coordinate layout and installation of roof accessories with interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation and mill phosphatized for field painting where indicated. Provide one of the following finishes as directed by Architect.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
4. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated. Provide one of the following finishes as directed by Architect.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
2. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
3. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required. Provide one of the following finishes as directed by Architect.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
4. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
5. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Two-Coat Fluoropolymer Finish: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
7. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

E. Copper Sheet: ASTM B 370, manufacturer's standard temper.

F. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

G. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

H. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.


2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.

C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
D. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AES Industries, Inc.
   b. LM Curbs.
   c. Metallic Products Corp.
   d. Roof Products, Inc.
   e. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

1. Height: 12 inches from roof to top of curb.

C. Material: As selected by Architect from manufacturer’s full range.

1. Finish: As selected by Architect from manufacturer’s full range.
D. Construction:

1. Insulation: Factory insulated with minimum 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer’s standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. LM Curbs.
   d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   e. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: As selected by Architect from manufacturer’s full range.

1. Finish: As selected by Architect from manufacturer’s full range.

D. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Factory-installed continuous wood nailers minimum 3-1/2 inches (90 mm) wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
6. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

   1. Coat concealed side of uncoated aluminum or stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.


C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200
PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
2. Construction–gap firestopping at connections of the same or different materials in fire-rated construction using fire-resistant sealants.
3. Construction–gap firestopping occurring within fire-rated walls using fire-resistant sealants.
4. Construction-gap firestopping occurring at the top of fire-rated walls.

B. Related Sections:

1. Division 07 Section “Joint Sealants.”
2. Division 23 Sections for fire dampers and manufactured mechanical devices.
3. Division 26 Sections for raceway seals, cable trays and manufactured electrical devices.

1.2 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors and floor/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   a. Penetrations located outside wall cavities.
   b. Penetrations located outside fire-resistance-rated shaft enclosures.
   c. Penetrations located in construction containing doors required to have a temperature-rise rating.
   d. Penetrating items larger than a 4 inch diameter nominal pipe or 16 sq.in. in overall cross-sectional area.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings required, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.3 SUBMITTALS

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

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

3. Any changes in conditions and designated systems require the Architect's prior approval.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Submit a schedule showing typical penetrations of each penetrating materials type, firestopping type to be used, F ratings, T ratings, UL or other acceptable testing agency reference numbers, and other pertinent data.

D. Qualification Data: For Installer.

E. Product Certificates:

1. Submit manufacturer's certification that materials supplied are in accordance with the specifications and requirements of the authorities having jurisdiction.

2. Submit certification that materials supplied are VOC compliant and are nontoxic to building occupants.
F. Product Test Reports: Submit product test reports from, and based on tests performed by a qualified testing and inspecting agency who is acceptable to ICBO and the University of Colorado at Boulder Department of Environmental Health and Safety evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

C. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistant joint systems in Project to a single qualified installer.

D. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

E. Standards: Conform to applicable standards, including, but not limited to the following:
   2. ASTM E 814 Test Method of Fire Tests of Through-Penetration Firestops.

F. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Perform firstopping tests by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to the University of Colorado at Boulder Department of Environmental Health and Safety.
   2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying the following requirements:
      a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
      b. Through-penetration firestop systems correspond to those indicated by reference to system designations listed by UN in their "Fire Resistance Directory" or by Warnock Hersey.
   3. Fire-resistant joint sealant systems must be identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
      a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to designations listed by UL in their "Fire Resistance Directory."
      b. Furnish joint sealants, including backing materials bearing classification marking of qualified testing and inspection agency.
G. Preconstruction Laboratory Tests:

1. Submit substrate materials representative of actual joint surfaces to be sealed to manufacturer of firestopping products for laboratory testing of firestop materials for adhesion to primed and unprimed substrate joints and for compatibility with secondary seals, if require, as indicated below:
   
a. Use test methods standard with manufacturer to determine if priming and other specific substrate preparation techniques are required to obtain rapid, optimum adhesion of firestopping to substrate joints under environmental conditions that will exist during actual installation.
   
b. Testing will not be required when firstopping manufacturer is able to submit preparation data required above which is based on previous testing of current firestopping products for adhesion to, and compatibility with, substrates matching those submitted.

H. Detectable Asbestos: Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, “Polarized Light Microscopy.”

I. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
1.8 WARRANTY

A. Submit 2 copies of written 2 year warranty agreeing to repair or replace firestopping which fails to perform as airtight and watertight joints; or fails in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appears to deteriorate in any other manner not clearly specified by submitted manufacturer’s data as an inherent quality of the material for the exposure indicated.

B. Provide warranty signed by the Installer and Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 that are produced by one of the following manufacturers:

1. 3M Fire Protection Products.
2. Bio-Firesheild Inc.
4. Hilti Inc.
5. Other manufacturers offering UL listings for approval and consideration by the University of Colorado at Boulder.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping, joint fillers, dams and other related materials that are compatible with one another and with joint substrates under conditions of service and application, a demonstrated by testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Semirefractory fiber (mineral wool) insulation.
   b. Ceramic fiber.
   c. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      1) Fire-rated formboard.
      2) Joint fillers for joint sealants.
   d. Temporary forming materials.
   e. Substrate primers.
   f. Collars.
   g. Steel sleeves.
C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system’s seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. General: Prepare a schedule showing typical penetrations of each penetrating material type and other information as follows:

1. Project Name.
2. Construction Type.
3. Occupancy.
4. Firestop Applicator.

B. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL’s "Fire Resistance Directory" under product Category XHEZ.

C. Construction Assemblies:

1. Gypsum Board Walls.
2. CMU and Concrete Walls.
3. Concrete Floors.
4. Floor/Ceiling Assemblies.
5. Roof/Ceiling Assemblies.
7. Chases.
8. Curtain Walls.

D. Fire-Resistive Rating Requirements:

1. Furnish the following information for each type of construction assembly listed above:

   a. Hour fire rating.
   b. F Rating.
   c. T Rating.
   d. Qualified testing agency Design No.
   e. Penetrating intem.
   f. Penetrating materials and size.
   g. Minimum annular space.
   h. Maximum annular space.
   i. Architect’s detail and sheet number.
   j. Shop drawing detail or sheet number.

END OF SECTION 078413
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants.

B. Related Sections:
   1. Division 07 Section "Penetration Firestopping" for sealing joints in fire-resistance-rated construction.
   2. Division 07 Section "Expansion Control" for building expansion joints.
   3. Division 09 Section "Gypsum Board" for sealing perimeter joints.
   4. Division 09 Section "Tiling" for sealing tile joints.
   5. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Manufacturer’s surface preparation and installation instructions under provisions of Division 01 Section “Submittals, Shop Drawings, Product Data and Samples.”

C. Samples for Initial Selection: Manufacturer’s color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

E. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

F. Qualification Data: For qualified Installer.

G. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
I. Warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Application shall be done by a joint sealant Subcontractor with five years experience. Submit documentation to the Architect and Owner.

B. Manufacturer Technical Assistance: Materials shall be supplied by manufacturer who will provide qualified technical assistance at the Project site.

C. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

D. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Submit 2 copies of written 2 year warranty agreeing to repair or replace joint sealers which fail to perform as airtight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified by submitted manufacturer’s data as an inherent quality of the material for the exposure indicated.

B. Provide warranty signed by the Installer and Contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Dow Corning.
2. General Electric.
4. Pecora Corporation.
5. Sika Corporation.
6. Sonneborn Building Products.
7. Tremco Manufacturing.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience of material matching the appearance of exposed surfaces adjacent to joint sealants.

B. Colors of Exposed Joint Sealants: As selected by Contractor from manufacturer's full range.

2.3 SEALANTS

A. One-Component Acrylic Sealant:
   1. Acrylic emulsion sealant, one-part, mildew resistant and paintable, complying with ASTM C 834, recommended by manufacturer for general use as an exposed building construction sealant.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Pecora AC-20.

B. Interior Silicone Rubber Sealant:
   1. Silicone rubber-based, one-part elastomeric sealant, complying with ASTM C 920, Type S, Class 25, Grade NS.
   2. Use acid-type for non-porous joint surfaces, and non-acid type where one or both joint surfaces are porous.
   3. For wet areas use type compounded specifically for mildew resistance.
   4. Use for interior joints between equipment or counters and walls.

C. Two-Component Polyurethane Sealant:
   1. Polyurethane-based, 2-part elastomeric sealant, complying with ASTM C 920, Type M, Class 25, Grade NS 9non-sag).
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Pecora Dynatrol II.
         2) Tremco Dymeric.
   2. Optional Sealant: Contractor may, at Contractor’s option, provide 1-Component Silicone Sealant, “Silpruf” by General Electric or #790 by Dow-Corning in lieu of those listed above.

D. Backer Rod: Compressible, closed cell non-gassing type compatible with required sealant.
2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:

1. For side walks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of the joint width, but neither more than 0.625 inch deep nor less than 0.375 inch deep.
2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 0.5 inch deep nor less than 0.25 inch deep.

3. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

C. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.4 SCHEDULE OF SEALANT APPLICATION

A. At joints in vertical planes on exterior of building and interior face of through expansion or control joints, provide non-sag type polyurethane or silicone sealant.

B. At joints in horizontal planes on interior and exterior of building, provide self-leveling type polyurethane sealant.

C. At joints on interior of building, except as indicated in paragraph A above, provide acrylic type sealant.

D. At perimeter of plumbing fixtures, and kitchen equipment provide silicone type sealant.

E. Set all thresholds in full bed of urethane type caulking.

F. See Drawings for typical locations.

G. Humidity and temperature controlled computer rooms:
   1. All walls fully sealed to the structure top and bottom.
   2. Sealant around all electrical outlets, panel boxes, etc.
   3. Expandable foam around sides and back of all electrical outlets, panel boxes, etc.
   4. All openings, into computer room, into access floor space, and into space above ceiling shall be completely sealed.

END OF SECTION 079200
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes architectural joint systems for building interiors.

B. Related requirements include Division 07 Section "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.2 DEFINITIONS

A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.

D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.3 SUBMITTALS

A. Shop Drawings: Provide the following for each joint system specified:

1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

2. Architectural Joint System Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

a. Manufacturer and model number for each joint system.
b. Joint system location cross-referenced to Drawings.
c. Nominal joint width.
d. Movement capability.
e. Classification as thermal or seismic.
f. Materials, colors, and finishes.
g. Product options.
h. Fire-resistance ratings.

B. Samples for Initial Selection: For each type of joint system indicated.

1. Include manufacturer’s color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

C. Samples for Verification: For each type of architectural joint system indicated.
1. Full width by 6 inches (150 mm) long, for each system required.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for current products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain interior architectural joint systems through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

2. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

3. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

4. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.

B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.

1. Remove tool and die marks and stretch lines or blend into finish.

2. Finish: 4, directional satin.

a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
C. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Compression Seals: ASTM E 1612; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

E. Strip Seals: ASTM E 1783; preformed elastomeric membrane or tubular extrusions having an internal baffle system and secured in or over a joint by a metal locking rail.

F. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

G. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.

H. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.

I. Moisture Barrier: Flexible elastomeric material, EPDM, minimum 45 mils thick.

J. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 ARCHITECTURAL JOINT SYSTEMS, GENERAL

A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where joint changes direction or abuts other materials.
2. Include factory-fabricated closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.

B. Design architectural joint systems for the following size and movement characteristics:

1. Nominal Joint Width: As indicated on Drawings.
2. Maximum Joint Width: As indicated on Drawings.
3. Minimum Joint Width: As indicated on Drawings.
4. Movement Capability: As indicated on Drawings.
5. Type of Movement: As indicated on Drawings.

2.3 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. MM Systems Corporation.
2. Watson Bowman Acme Corp.
B. Interior Floor Joint System: As indicated on Drawings.

C. Interior Wall and Ceiling Joint System: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.

C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

D. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.

3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.

4. Locate in continuous contact with adjacent surfaces.


6. Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.

7. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer’s written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces and sides of slabs before installing compression seals.

E. Foam Seals: Install with adhesive recommended by manufacturer.

F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.

G. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

H. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow metal doors and frames.

B. Related Sections:
   1. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
   2. Division 09 Sections "Interior Painting" for field painting hollow metal doors and frames.

1.2 SYSTEM DESCRIPTION

A. Normal Door Sizes as Follows: Larger openings may be considered where appropriate, per review with the University of Colorado at Boulder Architect.

1. Interior Doors:
   a. Classrooms and Public Assembly Rooms (capacity requirements as determined by code): 3 by 7 feet for single openings and 6 by 7 feet for double openings.
   b. Offices and Secondary Rooms (including Custodial Work Stations): 3 by 7 feet.
   c. Toilet Rooms and Service Rooms: 3 by 7 feet.
   d. Closets: 8 feet 8 inches by 7 feet.

2. Reinforce doors for all required hardware.

B. Interior Frames:

1. Metal frames, 16 gauge minimum, heavier if doors are wider than 3 feet. Continuously weld and grind smooth all corner joints and contact edges once joints are closed tight.
2. Anchoring: Securely anchor all frames to the floor. Minimum three wall anchors on each jamb.
3. Reinforce frames for all required hardware.
4. "Knock-down" type frames are not acceptable except when approved by the University of Colorado Boulder in exceptional situations such as remodeling projects.
5. Grout: Fill with mortar all metal door frames in masonry walls.

C. Clearances:

1. Between doors and frames at head and jamb, 1/8 inch.
2. At sill where no threshold is used, ½ inch. Where threshold is used, 1/8 inch between door and threshold.
3. Between meeting edge of doors in pairs, 1/8 inch.
4. Bevel edges of single acting doors 1/8 inch per 2 inches.
5. Coordinate door height with floor covering thickness.
1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Submit shop drawings for the fabrication and installation of hollow metal work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections tied to a schedule.

C. Samples for Verification:

   1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

1.4 QUALITY ASSURANCE

A. Standards: Conform to SDI 100, grade III or NAAMM Standard HMMA 861 except where more stringent requirements are specified.

B. Fire-Rated Door Assemblies:

   1. Provide fire-rated hollow metal doors and frames that comply with NFPA 80 and tested as a fire door assembly, complete with type of fire door hardware to be used, in accordance with ASTM E 152.
   2. Identify each fire door and frame with either UL or Warnock Hersey labels, indicating applicable fire rating of both door and frame.
   3. Temperature-Rise Limit: At stairwell enclosures, provide doors which have a temperature rise rating of not more than 450 deg F maximum to 30 minutes of fire exposure.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

   1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.
1.6 PROJECT CONDITIONS
   
A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Ceco Door Products; an Assa Abloy Group company.
   2. Curries Company; an Assa Abloy Group company.
   3. Fenstra.
   4. Kewanee Corporation (The).
   5. NCS.
   6. Republic.
   7. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

D. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

E. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.3 HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
1. Design: As indicated.
2. Face Sheets: 18 gauge minimum for interior doors.
3. Sound-Deadening: Manufacturer's standard fiberglass insulation for all hollow metal doors.
   a. Internal stiffeners:
      1) Support surface sheets by 22 gauge “Z” or Hat channel, or 28 gauge continuous truss members spaced 6 inches o.c. maximum. Spot weld “Z” or Hat channel to both surface sheets at 5 inches o.c. Spot weld continuous truss members to both surface sheets at 3 inches o.c.
      2) Support edges of doors by 16 gauge continuous interior edge channels.
   b. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
   c. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with U-value of 0.24 BTU/hr/sq. ft./degree F, when tested according to ASTM C 236.
      1) Locations: Exterior doors and interior doors where indicated.
5. Seamless Construction: No visible seams along face sheets or vertical edges.
6. Glazing Stops:
   a. 18 gauge stops with all corners mitered and welded.
   b. Integral with frame on the exterior side.
   c. Interior Glazing: Anchor stops with countersunk oval head screws. For interior doors, locate stops on secure side of door.

2.4 HOLLOW METAL FRAMES

A. Frames:

1. Minimum Gauges:
   a. All interior frames over 36 inches with: 14 gauge.
   b. All other interior door and window frames: 16 gauge.
   c. Loose glazing stops: 18 gauge.

2. Stops:
   a. 5/8 inch deep door and glazing stops.
   b. Rolled steel sections for fire-rated openings.

3. Anchors:
   a. Fire-Rated Openings: UL rated.
   c. Steel or Wood Stud: Minimum 16 gauge “Z” shape.
   d. Concrete: Minimum 12 gauge “4” shape spacer and ¼ inch diameter expansion anchors.
2.5 PREPARATION FOR FINISH HARDWARE

A. Doors and Frames: Spot weld all reinforcement at the factory. Drill and tap for mortise template hardware.

B. Frame Reinforcement Minimum Standard:
   1. Butt Hinges: One piece 7 gauge plate 12 inches long by full width of jamb at each hinge.
   2. Closers: 10 gauge channel section 12 inches long and full width of frame trim.
   3. Strikes, Flush Bolts, and all Other Surface Mounted Hardware: 12 gauge.
   4. Reinforce frames in direct proportion to the size and weight of door.

C. Door Reinforcement Minimum Standard:
   1. Butt Hinges: 7 gauge plate 9 inches long welded to 16 gauge interior edge channels at each hinge.
   2. Surface Applied Closers: 12 gauge box section minimum 4 inches deep and 12 inches long.
   3. Locksets, Deadbolts, Panic Devices: 12 gauge.

2.6 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.

C. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.7 STEEL FINISHES

A. Interior Locations: Zinc coating complying with ASTM A 525, G01.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with HMMA 840.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. **In-Place Concrete or Masonry Construction:** Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. **In-Place Gypsum Board Partitions:** Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. **Ceiling Struts:** Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. **Installation Tolerances:** Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. **Squareness:** Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. **Alignment:** Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. **Twist:** Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. **Plumbness:** Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. **Hollow Metal Doors:** Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. **Non-Fire-Rated Standard Steel Doors:**
   a. **Jambs and Head:** 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. **Between Edges of Pairs of Doors:** 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. **Between Bottom of Door and Top of Threshold:** Maximum 3/8 inch (9.5 mm).
   d. **Between Bottom of Door and Top of Finish Floor (No Threshold):** Maximum 3/4 inch (19 mm).

2. **Fire-Rated Doors:** Install doors with clearances according to NFPA 80.

D. **Glazing:** Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

### 3.4 ADJUSTING AND CLEANING

A. **Final Adjustments:** Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

2. Flush wood doors and panels with veneer facings.
3. Pre-fitting and pre-machining for fire-rated and 20 minute wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification: Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.3 QUALITY ASSURANCE


B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to ASTM E 152. Provide doors labeled by UL or Warnock Hersey.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Mark each door on bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
1.6 WARRANTY

A. Specific Product Warranty: Submit 2 copies of written agreement on door manufacturer’s standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or which show telegraphing of core construction below in face veneers, or do not conform to tolerance limitations of referenced quality standards.

B. The warranty shall also include refinishing and reinstallation which may be required due to repair or replacement of defective doors.

C. Warranty for solid core flush interior doors shall be in effect for the lifetime of the installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Weyerhaeuser Co.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors: AWI “PC-5” type, solid particleboard core with solid stiles. Provide mineral core doors with fire-rating as scheduled.

B. Faces: AWI Premium Grade plain sliced red oak or birch veneers, both sides. Match existing, adjacent veneers in remodel work.

C. Edge Stile: Solid hardwood to match face veneers without finger jointing.

D. Adhesives: NWWDA I.S. 1.6 Type 1.

E. Glazing Stops: 20 gauge cold-rolled steel channel. For fire-rated doors, provide glazing stops with UL or Warnock Hersey label.

2.3 FABRICATION

A. Pre-fit and pre-machine fire-rated and 20 minute wood doors at the factory or at a labeling agency licensed machinist.

B. Comply with the tolerance requirements of AWI for pre-fitting.
2.4 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish. Field re-finish immediately after field machining.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI catalyzed polyurethane system.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 TOLERANCES

A. Non Fire-Rated Doors: Provide 1/8 inch at jambs and leads, 1/8 inch (1/16 inch per leaf) at meeting stiles on pairs of doors and ½ inch from bottom of door to top of floor finish or covering. Provide ¼ inch clearance at thresholds. Bevel doors 1/8 inch in 2 inches at lock and hinge edges.

B. Fire-Rated Doors: Comply with NFPA 80. Provide proper fit and uniform clearance.
3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416
PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. Fire resistive rated and non-rated access doors and frames.
   2. Floor and ceiling access hatches.

1.2 SUBMITTALS

A. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).
   1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

B. Shop drawings showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

A. Where fire-rated assemblies are required, provide assemblies complying with NFPA 80 and tested in accordance with ASTM E 152.

B. Provide units labeled by UL or Warnock Hersey.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include the following:

   1. Access Hatches:
      b. The Bilco Co.
      c. Dur-Red Products.
2. Wall and Ceiling Access Doors:
   a. Nystrom, Inc. (specified to establish level of quality).
   b. Bar Co., Inc.
   c. J.L. Industries.
   e. Milcor.
   f. The Williams Brothers Corp.

2.2 MATERIALS

A. Zinc-Coated Steel Sheet: ASTM A 591 (ASTM A 591M), Electrolytic zinc-coated steel sheet with Class C coating and phosphate treatment to prepare surface for electrostatically painting.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

2. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

3. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

4. Color: Match adjacent ceiling and wall color.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

2.3 WALL AND CEILING ACCESS UNITS:

A. Access Panels – Masonry Walls: Flush, Style TM by Nystrom, 16 gauge frame, 14 gauge panel, concealed spring hinges, masonry anchors.

B. Access Panels – Gypsum Board Wall and Ceilings: Flush, Style WB by Nystrom, 16 gauge frame, 14 gauge panel, galvanized steel drywall bead, concealed spring hinges.

C. Access Panels – Acoustical Panel Ceilings: Recessed to receive acoustical panel, Style RA by Nystrom, 16 gauge steel frame, 16 gauge panel, concealed pivoting rod hinge.

D. Access Panels – Plaster: Flush, Style PW by Nystrom, 16 gauge frame, 14 gauge panel, galvanized steel plaster bead with expanded metal lath, concealed spring hinges.

E. Access Panels – Ceramic Tile: Flush, Style WB by Nystrom, 16 gauge frame, 14 gauge panel, concealed spring hinges.
F. Access Panels – Concrete: Flush, Style TM by Nystrom, 16 gauge frame, 14 gauge panel, concealed spring pin hinge.

G. Sizes (unless otherwise on the Drawings):

H. Finish: Phosphate dipped with baked on rust inhibitive gray primer.

I. Locking:
   1. Non-Rated Areas: Flush, screw-driver operated cam latch.
   2. Fire-Rated Areas: Raised knob cam locks.
   3. Special Areas as Designated: Cylinder locks with all units keyed alike.

2.4 ACCESS HATCHES

A. Design:
   1. Installation: Recessed
   2. Finish: To receive floor or ceiling finish as scheduled, if in a public are.

B. Location: Accessible in a non-public location if possible.

2.5 FABRICATION

A. General: Manufacture each access door assembly as an integral unit ready for installation.

B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

   1. Exposed Flange: Nominal 1 inch wide around perimeter of frame.
   2. For gypsum board assemblies, furnish frames with edge trim for gypsum board in accordance with Drywall Flange-Flush Doors requirements within this section.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for installing access doors.
B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.

C. Install concealed-frame access doors flush with adjacent finish surfaces.

D. Provide the owner with all related access doors and frames hardware, keys, maintenance manuals and warranties at time of substantial completion.

3.3 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08311
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Items known commercially as finish hardware or builders hardware, required for swing, or folding doors.
2. Types of finish hardware:
   a. Hinges.
   b. Pivots.
   c. Lock cylinders and keys.
   d. Lock and latch sets.
   e. Bolts.
   f. Exit devices.
   g. Push/Pull units.
   h. Closers.
   i. Overhead holders.
   j. Miscellaneous door control devices.
   k. Door trim units.
   l. Protection plates.
   m. Sound stripping for interior doors.
   n. Automatic drop seals (door bottoms).
   o. Astragals or meeting seals on pair of doors.
   p. Automatic door operators.

B. Related Sections:

1. Division 06 Section “Interior Architectural Woodwork.”
2. Division 08 Section “Hollow Metal Doors and Frames.”
3. Division 08 Section “Flush Wood Doors.”

1.2 REFERENCES


B. Fire-Rated Openings:

1. National Fire Protection Association (NFPA) Standard No. 80. This requirement takes precedence over other requirements for such hardware.
2. Underwriters Laboratory (UL).

C. Emergency Exit Devices:

1. Fire-rated Doors: Provide UL or WHI label on exit devices indicating “Fire Exit Hardware.”
1.3 SUBMITTALS
   A. Product Data: Manufacturer's standard product data of each item of hardware.
   B. Hardware Schedule:
      1. Organize hardware schedule into hardware sets indicating complete designations of every item.
      2. Include specific hardware directions for every door opening.
   C. Templates: Hardware templates to fabricators of other work which is to receive finish hardware.

1.4 PRE AND POST INSTALLATION AND INSPECTION
   A. After installation of all door closers, locks, and exit devices, General Contractor to have Manufacturer's representative submit a written report to the Architect with copies to the General Contractor and hardware supplier upon completion of service. This report shall include any installation errors and specifying specific door number.

1.5 QUALITY ASSURANCE
   A. Supplier Qualifications:
      1. Recognized builders hardware supplier, with warehousing facilities, who has been furnish hardware in the Denver-Metro area for a period of not less than 3 years.
      2. Employs an experienced AHC certified hardware consultant, available for consultation during the course of the Work.

1.6 WARRANTY
   A. Mechanical failure on door closers for 10 years.
   B. Blanket coverage on locksets for 5 years.
   C. Failure on parts of all hardware except door closers for 2 years.

PART 2 - PRODUCTS

2.1 HINGES
   A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1. Hager; BB1279, BB1199, or BB1168.
      2. Ives; 5BB1, 5BB1-HW (Brass), or 5BB1-HW (Steel).
      3. Stanley; FBB179, FBB199, or FBB168.
   B. Five knuckle, button tip, full mortise template type with non-rising loose pins and ball or iolite bearings.
   C. Interior Doors: Ball bearing type, wrought steel construction, with .134 or .145 gauge.
1. Doors to 36 inches width: 4.5 by 4.5 inch hinges.
2. Doors over 36 inch width: 5 by 5 inch hinges.

D. Number of Hinges:
1. Minimum 3 hinges per door leaf for doors 84 inches or less in height.
2. One additional hinge for each 24 inches of additional height.

2.2 LOCKS

A. Manufacturer: Provide the following (no substitutions allowed):
1. Schlage L9000 Series with the following characteristics:
   a. Non-handed case.
   b. Ability to reverse locking hub without opening case cover.
   c. Independent spindles.
2. Minor rekeying at Remodel Work: Match existing key system.

B. Heavy-duty mortise type.

C. Supply all locks with construction cylinders to secure the building until replaced by Owner with “Medeco” cylinders at job completion. All locks must accommodate “Medeco” cylinders.

D. Lock Throw: ¾ inch minimum throw of latch and 1 inch minimum throw of deadbolt.

E. Trim: Cast lever and cast escutcheon, Schlage Lock Co. #03L (no substitutions allowed).

F. Finishes: Architect to secure permission from the University of Colorado at Boulder for alternate finishes than those listed below.
2. Remodel Projects: Match finish of existing hardware in adjacent areas.

2.3 DOOR CLOSERS

A. Manufacturer:
1. LCN Closers; a division of Ingersoll Rand (no substitutions allowed).
2. Closer Series is 4040XP on exterior doors only or as directed by Access Services for high usage doors. All other doors requiring closure use 4010.
   a. Provide EDA arm (Extra Duty Arm) on parallel arm applications.
   b. Provide “CUSH” arm where required.

B. Through bolted on all doors unless otherwise directed by Owner.

C. Surface Mounted Closers: Product of a single manufacturer.

D. Interior Doors: Delayed action and conform to UFAS requirements.

E. Size of Units: Adjust closers to comply with the manufacturer’s recommendations for size of door control unit, depending upon size of door, exposure to weather, wind conditions, and adjust for positive latching security doors.
2.4 EXIT DEVICES

A. Manufacturer:
   1. Von Duprin, Inc. (no substitutions allowed).
   2. Vertical rods shall be 9927 Less Bottom Rod for Wood Doors and 9947 Less Bottom Rod for Metal Doors requiring a fire rating with double door situation with no mullion.
   3. Series shall be Von Duprin #99 (or #33 if necessary).

B. Exit Device Dogging: Except on fire-rated doors, wherever closures are provided on doors equipped with exit devices, equip the units with Allen key dogging device to hold the push bar down and the latch bolt in the open position.

C. Fire-Rated Exit Devices: Provide with UL label showing listing for “Fire Exit Hardware.”

D. Through-bolt on all doors including center cases, end cases, rod guides and latches.

2.5 DOOR TRIM, STOPS, AND HODLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Glynn-Johnson.
   2. Hager.
   3. Ives.
   4. Master Manufacturers, Inc.
   5. Quality.
   6. Rockwood.
   7. Trimco.

B. Door Stops: Locate in position to permit maximum door swing but not to present a hazard or obstruction.

C. Push/Pull Units and Kick Plates:
   1. Manufacturer's standard exposed fasteners.
   2. Through-bolted push/pull units for matched pairs, but not for single units.
   3. Trim Plates: .050 inch thickness.
   4. Protection Plates (armor, kick, or mop): Minimum 2 inches less than door width on stop side and minimum 1/2 inch less than door width on pull side.
   5. Wheelchair Entries: Kick plates shall be a minimum 12 inches high.

D. Overhead Holders: Glynn-Johnson 900 or 100 Series (no substitutions allowed).
   1. Use surface mounted devices unless otherwise approved by the Owner.
   2. Through bolt mount all doors unless otherwise approved by the Owner.
   3. Do not use devices with ‘hold-open’ feature, electromagnetic or otherwise, for doors which are to be used for “airlock” vestibules (typically at exterior doors), or stairwells that serve as vestibules.

E. Automatic Flush Bolts and Coordinators: Do not use automatic flush bolts or coordinators unless otherwise approved by the Owner or required by Code.
2.6  DOOR STRIP UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Master Manufacturers, Inc.
   2. National Guard.
   3. Pemko.
   4. Reese.
   5. Zero.

B. Smoke Seal Applications: As required to meet all applicable codes.
   1. Provide National Guard No. 2525 or other approved substitute.

C. Fasteners: Unless otherwise noted, use manufacturer’s standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops, and similar units).
   1. Noncorrosive fasteners as recommended by manufacturer for application indicated.

D. Weatherstrip and Smoke Seals: Silicone rubber seal; vinyl is not acceptable.

2.7  FINISHES

A. Match the finish of the locksets.

B. Closers: Finish to match door hardware (powder coated).

C. Coordinate all the various manufactured items furnished on the Work to ensure an acceptable uniform finish.

2.8  KEYING

A. Final cylinders and keying shall be “Medeco” purchased by the Owner and installed by the Contractor.

2.9  AUTOMATIC DOOR OPERATORS

A. Manufacturer: Provide the following; no substitutions:
   1. LCN Closers, a division of Ingersoll Rand; LCN-Pneumatic.
      a. Power keyed cutoff switch (contact Access Services for type). Reference UCB Standards 08740, Part 2.1, B. 7981 ES or 7982ES.

B. Handicap Accessibility Features: Design system to allow handicap access after-hours when building is secured. Provide devices which may be left turned on after-hours without causing damage or undue wear to the device or any other associated hardware. Use ES relay if integrated into electronic hardware.

C. Rod and Arm Assembly Shoes: Through bolt on all doors.

D. Wall Plate Actuators: 8310-856 Hardwired or 8310-844 & 8310-865.
E. Card Reader Integration or Exterior Disable: Contact Access Services.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The General Contractor in conjunction with the hardware installer and supplying distributor shall examine doors and frames as follows.
   1. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. Ensure that walls and frames are square and plumb before hardware installation.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.
   3. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Wood Doors: Comply with DHI A115-W series.
B. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI/SDI A250.6-97.

3.3 INSTALLATION

A. Use the templates provided by hardware item manufacturer.
B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Conform to ANSI A117.1 for positioning requirements for the handicapped.
   2. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
C. Wherever cutting and fitting are required to install hardware on surfaces which are to be painted or finished by others, coordinate removal, storage, and reinstallation or application of surface protections with finishing work specified in other Sections. Do not install surface-mounted items until finishes have been completed on the substrate. NOTE: NO POWER DRIVEN TOOLS SHALL BE USED FOR INSTALLATION OF LOCKSETS AND HARDWARE ON DOORS.
D. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as required for proper installation and operation.
E. Drill and countersink units, which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with referenced standards.
F. Drill pilot holes for fasteners in wood doors and/or frames.
G. Drawings typically depict doors at 90 degrees; doors will actually swing to maximum allowable. Template hardware for maximum allowable degree of swing.
H. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc. Install sweeps across bottoms of doors before astragals, trim astragals to tops of sweeps. Door Jambs shall be cleaned of all dirt, grease, oil, solvents or solvent residue and dust before applying Pressure-Sensitive Adhesive backed Gasketing, Smoke Seal.

3.4 ADJUSTING

A. Adjust and check each operating hardware item, and each door assembly to ensure proper operation and function. Lubricate moving parts with lubrication type recommended by manufacturer.

B. Replace units, which cannot be adjusted and lubricated to operate freely and smoothly.

C. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner’s satisfaction.

D. Make final adjustments and lubrication immediately prior to final acceptance. Adjust door control devices to compensate for final operation of heating and ventilation equipment.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

2. Backcheck shall be properly located for protection of the door, frame, and applied hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION 087100
PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. Float glass.
   2. Tempered glass.
   3. Custom mirrors.

B. Related Section Includes
   1. Division 08 Section “Hollow Metal Doors and Frames.”
   2. Division 08 Section “Flush Wood Doors.”

1.2 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer’s written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data showing thermal performance characteristics of glass units.

B. Product Test Reports: From a qualified testing agency indicating the following products comply with requirements, based on comprehensive testing of current products:
   1. Float glass.
   2. Glazing sealants.

C. Glass Samples: Submit two samples of each type of glass specified, 12 by 12 inches in size, illustrating glass, units, and coloration. Indicate range of variation to be expected for color and ‘waviness’ in final position.
D. Glazing Accessory Samples: For gaskets and sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

E. Warranty.

1.5 QUALITY ASSURANCE

A. Installer shall have a minimum of 5 years experience in projects of similar size and complexity.

B. Conform to Flat Glass Marketing Association (FGMA) “Glazing Manual” and “Sealant Manual” for glazing standards.

C. Prime (Float) Glass: ASTM C 1036.


E. Elastomeric Sealant Standard: Comply with ASTM C 920 requirements for Type, Grade, Class and Uses.

F. Manufacturers: Provide each type of glass and primary sealant/gasket from a single manufacturer with not less than 5 years of successful experience in the production of materials similar to those required.

1.6 WARRANTY

A. Provide insulation glass manufacturer’s written warranty, agreeing to, within specified warranty period.

B. Warranty shall include replacement installation costs.

C. Warranty period is 10 years after seal date permanently imprinted on unit, but not less than 9 years after the date of the Notice of Acceptance.

PART 2 – PRODUCTS

2.1 PRIME (NON-PROCESSED) GLASS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

1. AFG Industries, Inc.
2. Ford Glass Div.
4. LOF Glass, Inc.
5. PPG Industries, Inc.
6. Viracon.

B. Clear Float Glass:
1. Type I, Quality q3, Class 1 clear, 1/4 inch thick except as otherwise required to comply with applicable codes and regulating authorities.
2. Low-E coating is required for all exterior glazing, except doors.

2.2 PROCESSED GLASS

A. Tempered Glass:
   1. Prime glass of color and type indicated, which has been heat-treated to strengthen glass in bending to not less than 4.5 times annealed strength. Fully temper glass by horizontally heat treating with minimal waviness or distortion and with all areas free of tong marks.

B. Mirror Glass:
   1. Clear float glass (ASTM C 1036, Type 1, Class 1, Quality q2), 1/4 inch thick except as otherwise indicated/
   2. Silver coating, copper protective coating and 2 mil thick paint coating; comply with CS 27.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Glazing compounds may not contain asbestos.

2.7 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Maintain minimum glazing tolerance between glass faces and frame or metal stops as recommended by the Flat Glass Marketing Association. For 1/4-inch thick glass, maintain 1/8-inch clearance between glass face and metal stops.

D. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
3.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.6 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088000
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Section: Division 09 Section “Gypsum Board.”

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a testing and inspection agency.

B. Sound Transmission Characteristics: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspection agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Metal Support Materials:
      a. Clark Western Building Systems.
      b. Dietrich Industries, Inc.
      c. USG Interiors, Inc.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2.2 SUSPENSION SYSTEM COMPONENTS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Direct Suspension Systems:
      a. Georgia-Pacific Corp.
      b. Donn Corporation.
      c. National Rolling Mills Co.
      d. USG Interiors, Inc.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

C. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
   2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

D. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

E. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.

F. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: As indicated on Drawings.

G. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
   2. Steel Studs: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
      b. Depth: As indicated on Drawings.
   3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
      a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
   4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical or hat shaped.
H. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Basis-of-Design Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   b. Chicago Metallic Corporation; Drywall Furring System.
   c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
   2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-(50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-(50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Available Basis-of-Design Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
         1) Steel Network Inc. (The); Verti Series.
         2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).

D. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: As indicated on Drawings.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
   2. Depth: As indicated on Drawings.
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F. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
   1. Configuration: Asymmetrical or hat shaped.

G. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: As indicated on Drawings.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
   1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
   2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
   4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING SUSPENSION SYSTEMS

A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

B. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb, unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
   c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
D. Direct Furring: Per ASTM C 645, 25 gauge.
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

   1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216
PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. Interior gypsum board.
   2. Ceramic tile substrate.

B. Related Sections include the following:
   1. Division 01 Section “Alternates.”
   2. Division 09 Section “Non-Structural Metal Framing” for non-structural framing and suspension systems that support gypsum board.
   3. Division 09 Section “Interior Painting” for primers applied to gypsum board surfaces.

1.2 SUBMITTALS

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

B. Manufacturer’s Data:
   1. Certification Requirements:
      a. Certify that products furnished for this Project are asbestos free.
      b. Certify that products meet or exceed specification requirements.
   2. Indicate compliance with specified fire or sound ratings.
   3. Indicate stud height limitations.

C. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Industry Standard: Comply with applicable requirements of ASTM C 840, “Application and Finishing of Gypsum Board” by the Gypsum Association, except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.

B. Allowable Tolerances: 1/16 inch offset between planes of board faces and 1/4 inch in 8'-0” for plumb, level, warp, and bow.

C. Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.

D. Comply with applicable requirements of Mountain States Bureau of Lath, Plaster and Drywall, Inc.
1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Basis-of-Design Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. G-P Gypsum.
   c. United States Gypsum Co.

B. Type X:

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
3. Gypsum sheathing board, square edges complying with ASTM C 79.
4. Water resistant, tapered edge gypsum backing board complying with ASTM C 630.
C. Type C:
   1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   2. Long Edges: Tapered.

D. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Long Edges: Tapered.

E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 5/8 inch (12.7 mm).
   2. Long Edges: Tapered.

F. Foil-Backed Type:
   1. Core: As indicated on Drawings.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

G. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
   1. Core: As indicated on Drawings.
   2. Long Edges: Tapered.

H. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
   1. Core: As indicated on Drawings.
   2. Plastic-Film Thickness: 0.030 inch (0.762 mm).

I. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.
   3. Comply with ASTM C 630.

2.3 ACCESSORIES

A. Accessories: Per ASTM C 840 as follows:
   1. Provide corner beads at all external corners, CB-118 x 118.
   2. LC-58 at all termination edges exposed to view.
   3. L-58 at all termination edges abutting another material.
   4. Expansion/control joints as recommended by manufacturer to be located by Architect approved substitute to No. 093 by U.S. Gypsum.
2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Treatment: Provide the following (or approved substitute):
   1. Durabond 90 by U.S. Gypsum Co.

C. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Ceramic Tile Substrate:
   1. 7/16 inch thick glass mesh reinforced cementitious board. Provide one of the following:
      b. USG Industries, Inc.; Durock.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) Type I, semi-rigid mineral or glass fiber blanket.
   2. Provide 1 1/2 inch mineral fiber 3.0 lb. density or full thickness of 1.0 density glass fiber.

F. Acoustical Sealant: Non-shrinking, non-drying, non-migrating and non-staining type formulated for acoustical use.
   1. Use one of the following:
      a. Pecora BA-98.
      b. Tremco Acoustical Sealant.
PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.2 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: Vertical surfaces, unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.
3. Type C: Where required for specific fire-resistance-rated assembly indicated.
4. Flexible Type: Apply in double layer at curved assemblies.
5. Ceiling Type: As indicated on Drawings.
6. Foil-Backed Type: As indicated on Drawings.
7. Abuse-Resistant Type: As indicated on Drawings.
8. High-Impact Type: As indicated on Drawings.
9. Moisture- and Mold-Resistant Type: As indicated on Drawings.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.
3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for thin set ceramic tile, acoustical tile, and where indicated.
3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges. Level 3 is suitable for surfaces receiving medium or heavy textured finishes before painting of wall covering in conditions where lighting conditions are not critical.
4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges. Level 4 is suitable for surfaces receiving light-textures finish, wall coverings, and flat paints. It is generally the standard exposed finish.
5. Level 5: Embed tape and apply separated first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface. Level 5 is suitable for surfaces receiving gloss enamels and surfaces subject to severe lighting. It is considered a high quality gypsum board finish reserved for only special applications.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

G. Acoustical Sealant: Provide acoustical sealant at all joints between drywall systems and adjoining materials.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Ceramic tile quality standards.
2. Ceramic tile.

B. Related Sections:

1. Division 01 Section “Alternates.”
2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 09 Section "Gypsum Board" for cementitious backer units and glass-mat, water-resistant backer board.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

1.3 SUBMITTALS

A. Manufacturer’s Data:

1. Certification Requirements:
   a. Certify that products furnished for this project are asbestos free.
   b. Certify that products meet or exceed specification requirements.


B. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Each type and composition of tile and for each color and texture required, at least 12 inches (300 mm) square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.

2. Full-size units of each type of trim and accessory for each color required.

3. Metal edge strips in 6-inch (150-mm) lengths.

C. Product Certificates:

1. Master Grade Certificate:
   a. Conform to ANSI A137.1.
   b. State grade, kind of tile, identification marks for tile packages, and name and location of project.
1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Not less than 3 years experience in ceramic tile installations similar in size, scope, and installation procedures required for this Project.
   2. Submit list to Architect of five contracts recently completed with names of Architects and General Contractors involved.

B. Furnish tile conforming with Standard Grade requirements of ANSI A137.1 with manufacturer’s label attached to each carton of tile certifying that it is “Standard Grade” per ANSI A137.1.

C. Except where otherwise specified, conform to Tile Council of America “Handbook for Ceramic Tile Installation” and ANSI A108, A118 and A136 as applicable.

D. When using setting and grouting materials manufactured under TCA license, include identification together with ingredients on each container.

E. Provide materials obtained from only one source for each type and color of tile.

F. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.5 MAINTENANCE MATERIAL REQUIREMENT

A. Extra Materials: Provide 5% of each size, type, and color of tile, but not less than 2 cartons; except in the case of accent colors, then the design consultant should recommend the appropriate quantities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. American Olean Tile Co., Inc.
   2. Buchtal Corp., USA.
   3. Florida Tile Div., Sikes Corp.
   4. Metropolitan Ceramics Div.; Metropolitan Industries, Inc.
   5. Monarch Tiles Manufacturing, Inc.
   6. Summitville Tiles, Inc.
   7. United States Ceramic Tile Co.
2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.


C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Restroom Floor Tiling: 12 inch ceramic tiles must be used with grey or black grouting. 1 inch floor tiles are unacceptable to the University of Colorado at Boulder standards.

2.3 TILE PRODUCTS

A. Tiling: As indicated on Drawings.

B. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
   1. Shapes: As indicated in "Finish Legend" on Drawings.

2.4 CERAMIC TILE FLOOR AND WALL SCHEDULE

A. Tile Floor Types:
   1. Tile Type/Products:
      a. Installation Method: Exterior floor installation on concrete; cement mortar bed (thickset) bonded to concrete; TCA F101 and ANSI A108.1C
   2. Tile Type/Products:
      a. Installation Method: Interior floor installation on concrete; cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1C
   3. Tile Type/Products:
      a. Installation Method: Interior floor installation on concrete; cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1C
4. Tile Type/Products:
   b. Setting Bed and Grout: ANSI A108.1A with the following grout:
      1) Commercial portland cement grout.

5. Tile Type/Products:
   b. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
      1) Dry-set or latex portland cement mortar.
      2) Sanded latex-portland cement grout.
      3) Dry-set grout.
      4) Unsanded latex-portland cement grout.

6. Tile Type/Products:
   a. Installation Method: TCA F113 (thin-set mortar bonded to concrete subfloor).
   b. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
      1) Dry-set or latex portland cement mortar.
      2) Sanded latex-portland cement grout.
      3) Dry-set grout.
      4) Unsanded latex-portland cement grout.

B. Tile Wall Types:

1. Tile Type/Products:
   a. Installation Method: Exterior or interior wall installation over masonry or concrete; cement mortar bed (thickset); TCA W201 and ANSI A108.1C
   b. Bond Coat Mortar for Wet-Set Method: Dry-set or Latex-portland cement mortar.

2. Tile Type/Products:
   a. Installation Method: Interior wall installation over clean, sound, dimensionally stable masonry or concrete; cement mortar bed (thickset) bonded to substrate; TCA W211 and ANSI A108.1C
   b. Bond Coat Mortar for Wet-Set Method: Dry-set or Latex-portland cement mortar.

3. Tile Type/Products:
   a. Installation Method: Interior wall installation over solid backing and solid anchorage for metal lath; cement mortar bed (thickset); TCA W221 and ANSI A108.1C.
   b. Bond Coat Mortar for Wet-Set Method: Dry-set or Latex-portland cement mortar.

4. Tile Type/Products:
   a. Installation Method: Interior wall installation over solid backing and solid anchorage for metal lath; one-coat cement mortar bed (thickset); TCA W222 and ANSI A108.1C.
   b. Bond Coat Mortar for Wet-Set Method: Dry-set or Latex-portland cement mortar.
5. **Tile Type/Products:**
   a. **Installation Method:** TCA W202 (thin-set mortar bed over sound, dimensionally stable masonry or concrete).
   b. **Setting Bed and Grout:** ANSI A108.5 with the following mortar and grout:
      1) Dry-set or latex portland cement mortar.
      2) Sanded latex-portland cement grout.
      3) Dry-set grout.
      4) Unsanded latex-portland cement grout.

6. **Tile Type/Products:**
   a. **Installation Methods:**
      1) TCA W243 (thin-set mortar bonded to gypsum board on metal or wood studs).
      2) TCA W244 (thin-set mortar bonded to cementitious backer units on metal or wood studs).
      3) TCA B412 (bathtub walls: thin-set mortar bonded to cementitious backer units on metal or wood studs).
   b. **Setting Bed and Grout:** ANSI A108.5 with the following mortar and grout:
      1) Dry-set portland cement mortar.
      2) Latex-portland cement mortar.
      3) Dry-set grout.
      4) Unsanded latex-portland cement grout.

2.5 **WATERPROOFING AND CRACK SUPPRESSION FOR THIN-SET TILE INSTALLATIONS**

A. **General:** Provide products that comply with ANSI A118.10 and the descriptions in this Article.

B. One-part liquid-applied urethane in a consistency suitable for trowel applications and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

C. **Available Products:** Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:
   1. Hydroment Ultra-Set; Bostik Construction Products Div.

D. Provide at all thinset floor tile applications above grade in wet areas.

2.6 **SETTING MATERIALS**

A. **Portland Cement Mortar Installation Materials:** Provide materials complying with ANSI A108.1A and as specified below:
   1. Latex-Rubber Waterproof Membrane: Manufacturer's standard factory-packaged, job-mixed, proprietary, 2-part formulation consisting of liquid-latex rubber and powder for trowel application and glass-fiber-fabric reinforcing.
a. Available Products: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:

1) Trowel & Seal Waterproof Membrane; Custom Building Products.
2) Laticrete 9235 Waterproof Membrane; Laticrete International, Inc.
3) S-9000; Summitville Tiles, Inc.

2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.

3. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.

a. Latex Additive: Manufacturer's standard.

2.7 GROUTING MATERIALS

A. Commercial Portland Cement Grout (Sanded Grout): ANSI A118.6, color as indicated, for joints 1/8 inch (3.2 mm) or wider.

B. Chemical-Resistant Epoxy Grout: ANSI A 118.3, color as selected by Architect from manufacturer standard range of available colors.

C. Unsanded.

2.8 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.9 MISCELLANEOUS MATERIALS

A. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.


1. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
3. Configuration over Studs and Furring: Flat.
5. Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).

C. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
D. Vapor Barrier: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.

E. Metal Edge Strips: White-zinc-alloy terrazzo strips, 1/8 inch (3.2 mm) wide at top edge with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.

F. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

G. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
   1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
   1. Petroleum paraffin wax or grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.


C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Floor must be stripped and scrubbed, with a minimum of two coats of approved grout sealer.
   1. Follow UCB Standards Section 01710.
H. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 VAPOR BARRIER INSTALLATION

A. Install waterproofing to produce a vapor barrier of uniform thickness bonded securely to substrate.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths unless indicated otherwise on the Drawings:

1. Floor Tile: 1/8 inch (6.35 mm), unless otherwise indicated.

C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:

1. Tile floors installed with chemical-resistant mortars and grouts.

D. Metal Edge Strips: Install at floor material transitions locations or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Wall Tile: 1/16 inch (1.6 mm), unless otherwise indicated.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.

   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093000
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Section: Division 09 Section “Gypsum Board” for acoustical tile substrates.

1.2 SUBMITTALS

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

B. Manufacturer’s Data:
   1. Certification Requirements:
      a. Certify that products furnished for this Project are asbestos free.
      b. Certify that products meet or exceed specification requirements.
   2. Maintenance:
      a. Submit instructions for proper maintenance and cleaning.
      b. Provide instructions for refinishing.
      c. Provide recommendations of precautions against materials and methods which may be detrimental to finishes and acoustical performance.

C. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:

D. Samples: Submit three 12 inch square samples of each type of acoustical material to illustrate color and range of appearance to be expected in completed work.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in the manufacture of acoustical ceiling tile and panels with 3 years minimum experience.

B. Installer’s Qualifications: Company with 3 years minimum experience and approved by manufacturer of acoustical units.

C. Terminology and Performance: Applicable publications by the Ceilings and Interior Systems Contractors’ Association (CISCA), including former Acoustical Materials Association Standards issued by CISCA.


E. Fire Hazard Classification: UL tested, listed and labeled as “Class O-25,” smoke developed

F. Fire-Test-Response Characteristics:
1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings UL tested, listed and labeled as the following:

   a. Flame-Spread Index: Comply with ASTM E84 for Class O-25 materials.
   b. Smoke-Developed Index: 50 or less.

G. Fire-Resistance Ratings: Comply with ASTM E 119 by UL; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

1.4 MAINTENANCE MATERIALS

A. At time of completing the installation, deliver stock of maintenance materials to the Owner. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels.

B. Acoustical Units: Furnish an amount equal to 2.0% of the amount installed of each type, pattern, color, but not less than 10 units. Do not use for replacement of damaged units prior to building occupancy or substantial completion whichever occurs later.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Acoustical Panel Standard: Comply with ASTM E 1264.


C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

   1. Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12 gauge diameter wire.

E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to those by the following manufacturers:

1. Armstrong World Industries, Inc.
2. Celotex Building Products Div.
3. Ecophon CertainTeed, Inc.
4. USG Interiors, Inc.

B. Type: Lay-in panels.

C. Requirements: As indicated on the Drawings.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, products by the following manufacturers:

1. Armstrong World Industries, Inc.
2. Celotex Building Products Div.
3. Ecophon CertainTeed, Inc.
4. USG Interiors, Inc.

B. Preferable Grid Module: 24 by 48 inches.

C. Grids Modules Not Acceptable: Any grid module with any dimension of 60 inches.

D. Coordinate with Divisions 23 and 26 to ensure proper type of diffuser and light fixture mounting to match panels and suspension system. Independently suspend light fixtures.

E. Concealed-spline ceilings are not permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with UBC Standard 25-2 and seismic design requirements indicated, per manufacturer’s written instructions and CISCA’s "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.

C. Suspend ceiling hangers from building’s structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 095113
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient stair accessories.
   3. Resilient molding accessories.

B. Related Sections:
   1. Division 01 Section “Alternates.”
   2. Division 09 Section "Resilient Floor Tile."

1.2 SUBMITTALS

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

B. Manufacturer’s Data:
   1. Certification Requirements;
      a. Certify that products furnished for this project are asbestos free.
      b. Certify that project meet or exceed specification requirements.

C. Samples: Submit a minimum of three samples of each type and color. Provide 6 inches minimum length for resilient base.

D. Product Schedule: For resilient products.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 3 years experience installing resilient floor base and accessories.

B. Codes/Standards: Conform to the following fire test data:
   1. Flame Spread: 75 or less per ASTM E 84.
   2. Smoke Density: 450 or less per ASTM E 662.
   3. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

C. Provide each type of resilient base and accessory produced a single manufacturer.
1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 MAINTENANCE MATERIALS

A. Extra Materials:
1. Furnish materials at the rate of 120 lineal feet (one carton) for each color and type of base installed.
2. Maintenance materials must be from the same manufactured lot as materials installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
2. Flexco Company.
4. Roppe Corporation, USA.

B. Resilient Base: Complying with FS SS-W-40A, Type I, roll stock rubber. Provide straight base without cove for carpet and topset style with coved base for all other locations.
1. Thickness: 0.125 inch (3.2 mm).
2. Height: 4 inches (102 mm).
3. Lengths: Coils in manufacturer's standard length.
4. Outside Corners: Job formed or preformed.
5. Inside Corners: Job formed or preformed.
6. Finish: As selected by Architect from manufacturer's full range.
7. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
   b. Flexco Company.
   c. Johnsonite.
   d. Roppe Corporation, USA.

B. Single-piece stair treads, 3/16 inch gauge minimum, with matching coved base and 0.080 inch gauge sheet rubber stringer skirt.
C. Color: As selected by Architect from manufacturer’s full range.

2.3 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
   b. Flexco, Inc.
   c. Johnsonite.
   d. Roppe Corporation, USA.

B. Description:

1. Carpet bar for tackless installations.
2. Carpet edge for glue-down applications
5. Reducer strip for resilient floor covering.
7. Transition strips.

C. Material: Rubber.

D. Profile and Dimensions: As indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.
3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.
3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:
   1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
   2. Tightly adhere to substrates throughout length of each piece.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet, resilient floor covering, tile and wood floors that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
   1. Apply two coat(s).

C. Cover resilient products until Substantial Completion.

END OF SECTION 096513
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resilient tile flooring.

B. Related Sections:
   1. Division 01 Section “Alternates.”
   2. Division 09 Section "Resilient Base and Accessories."

1.2 SUBMITTALS

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

B. Manufacturer’s Data:
   1. Certification Requirements;
      a. Certify that products furnished for this project are asbestos free.
      b. Certify that project meet or exceed specification requirements.

C. Samples: Submit a minimum of three samples of each type and color or pattern of resilient flooring. Provide full size tile samples. Provide full size tiles and 12 inch square pieces of sheet vinyl.

D. Product Schedule: For resilient products.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 3 years experience installing resilient flooring materials.

B. Codes/Standards: Conform to the following fire test data:
   1. Flame Spread: 75 or less per ASTM E 84.
   2. Smoke Density: 450 or less per ASTM E 662.
   3. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

C. Provide each type of resilient flooring and installation compounds produced a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).
1.5 MAINTENANCE MATERIALS

A. Extra Materials:
   1. Furnish materials at the rate of 2% of total square footage installed, but not less than one carton for each color and pattern of flooring.
   2. Maintenance materials must be from the same manufactured lot as materials installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
   2. Flexco Company.
   4. Roppe Corporation, USA.

2.2 RESILIENT TILE

A. Vinyl Composition Tile: ASTM F 1066, Class 1, solid-color tile (asbestos free).
   1. Thickness: 0.125 inch (3.2 mm).
   2. Size: 12 by 12 inches.
   3. Finish: As selected by Architect from manufacturer's full range.
   4. Colors and Patterns: As selected by Architect from full range of industry colors.

B. Rubber Floor Tile: FS SS-T-312, Type II, 1/8 inch gauge, pattern to match stair treads where directly adjacent to stair treads.

2.3 RESILIENT SHEET FLOORING

A. Comply with FS L-F-475, Type II, Grade A, 0.080 minimum gauge.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.
B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply one coat.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096520
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes direct glue-down carpet applications.

B. Related Section includes Division 01 Section “Alternates.”

1.2 REFERENCES


B. Uniform Federal Accessibility Standards.


1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include certified laboratory test reports for flammability and static tests.

B. Shop Drawings: Submit layout drawings showing seam locations, pattern, nap direction, and location and type of edge treatment.

C. Samples: Submit 18 by 27 inch samples of each type, color, texture and pattern of carpet required and 6 inch long samples of carpet edge guard stripping.

D. Qualification Data: For Installer.

E. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

F. Maintenance: Submit instructions for proper maintenance and cleaning.

G. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Installer: Firm with not less than 5 years of carpeting experience on projects of similar size and type of work in this Section.
   2. Manufacturer: Firm (carpet mill) with not less than 5 years of production experience with carpet manufacturing, and whose published product literature clearly indicates general compliance of products with requirement of this Section.
B. Fire-Test-Response Ratings: Where indicated, provide carpet and carpet cushion identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 MAINTENANCE MATERIALS

A. Extra Materials:
   1. The Owner will review all carpet scraps and retain chosen pieces for future repairs. Selected remnants, usable scraps and overage shall be packaged and identified. The balance shall be removed from the Project site.
   2. In addition to remnants and scraps, provide an additional 2% of each type, color, texture and pattern for future use, in full width roll.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.7 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

A. Provide special warranty, signed by Contractor, Installer and Manufacturer (Carpet Mill), agreeing to repair or replace defective materials and workmanship of carpeting work during 2 year warranty period following the date of the Notice of Acceptance. Attach copies of product warranties.

B. Furnish manufacturer's written warranty agreeing to supply replacement carpet if face weight loss in any area exceeds 10% in 10 years.

PART 2 - PRODUCTS

2.1 CARPET PERFORMANCE

A. Flammability:
   1. ASTM D 2859: Passing methenamine pill test.
   2. ASTM E 648: Minimum critical radiant flux of 0.45 watts per sq.cm.

B. Electrostatic Propensity:
   1. Static Generation: 3.0KV or less, 20% RH at 70 degrees R. per AATCC 134.
2.2 CARPET

A. Tuft Bind:
   1. Unitary type backing.
   2. Not less than 20 lb. average, ASTM D 1335.

B. Pile Height: Conform to UFAS or ANSI A117.1 for maximum height, whichever is stricter, 3/16 inch minimum.

C. Yarn and Construction Method:
   1. 30 oz. per sq/yd. minimum face weight using solution dyed material, cut pile or level loop style.
   2. Stitches and Gauge: Stitches per inch equal to or greater than the gauge.

D. Primary and Secondary Backings: Manufacturer's standard synthetic type.

E. Size: As indicated on Drawings.

F. Color and Pattern: As selected by Architect from manufacturer's full range.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesive: Water-resistant, mildew-resistant, non-staining, non-gassing (low VOC) type as recommended by the manufacturer for products and subfloor conditions indicated and shall be approved by the Owner. Comply with flammability requirements for installed carpet.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Prior to installation, all minor surface irregularities shall be repaired and the floor shall be thoroughly cleaned with all grit and dirt removed. Start of Work constitutes acceptance of floor and responsibility for finished result.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, “Site Conditions; Floor Preparation,” and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet manufacturer's written installation instructions.

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Lay carpet on floors with run of the pile in same direction as traffic flow.

C. Lay carpet on stairs with run of the pile in opposite direction of traffic to avoid peeking of backing on nosings.

D. Center seams under doors.

E. Do not seam in traffic direction at doorways.

F. Final Cleaning: Vacuum floors thoroughly.

END OF SECTION 096800
PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Complete painting of all surfaces throughout the interior and exterior of the buildings, except as otherwise specified or indicated in the finish schedule.
2. Field painting of exposed bare and covered pipes, conduits, hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work. Coordinate with Division 23 and 26 Installers and UCB staff for color coding.
3. Mechanical grilles, registers, louvers (except aluminum), panel covers and frames for electrical work.
4. Paint exterior roof, wall-mounted or ground mounted equipment including aluminum and factory finished items with colored approved by UCB.

B. Work Not Included:

1. Shop priming of ferrous metal items and fabricated components included under their respective sections.
2. Pre-finished items.
3. Integrally colored CMU or face brick.
4. Metal toilet partitions.
5. Acoustic materials.
6. Anodized aluminum.
7. Stainless steel.
8. Bronze.
9. Do not paint over any:
   a. Moving parts of operating units.
   b. Equipment identification.
   c. Performance rating data.
   d. Name or nomenclature plates.
   e. Code-required labels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples: Submit 3 sets of samples with scheduled color product type, color formula and texture to simulate actual conditions on 12 by 12 inch hardboard for Architect and UCB Project Manager review.
   1. Resubmit samples, if requested, until required sheen, color and texture is achieved.

C. On actual wall surfaces and other building components, duplicate painted finishes of acceptable samples, as directed by UCB Staff.
D. At beginning of Project, provide a complete summary list of specific manufacturer’s products, color identification numbers, manufacturer technical data sheets and MSDS Sheets that will be applied in this Project. List shall compare each color number with each specified or selected color number. A copy of this list shall be given to the appropriate UCB Project Manager, and Structural Analyst in Work Managements Group.

1.3 QUALITY ASSURANCE


B. All materials shall be applied free from runs, sags, wrinkles, streaks, shiners and brush marks.

C. All materials shall be applied uniformly. If any reduction of the coating’s viscosity is necessary, it shall be done in accordance with the manufacturer’s label direction.

D. New plaster and other masonry surfaces shall not be primed until it has been determined these substrates have dried sufficiently to safely accept paint. Unacceptable moisture content should be reported to the Architect or the Project Manager.

E. No exterior painting shall be undertaken if air or surface temperature is below 50 degrees F no immediately following rain or until frost, dew or condensation has evaporated.

F. A minimum interior temperature of 65° F shall be maintained during the actual application and drying of the paint, and until occupancy of the building occurs. Adequate ventilation shall be maintained at all time to control excessive humidity which will adversely affect the curing of coatings. The Contractor is solely responsible for maintaining suitable temperature and ventilation.

G. Before painting begins, all other crafts shall have completed their work, and shall have removed all dirt and debris resulting therefrom. The rooms or areas are to be left in broom clean condition.

H. Enamel and varnish undercoats are to be sanded smooth prior to the recoating. Tops and bottoms of doors are to be finished in the same manner as door facing, after the carpenters complete fitting them.

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1.4 EXTRA MATERIALS

A. Furnish extra materials (one gallon of each color to be provided) described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Leave on premises, where directed by the UCB Project Manager, not less than 1 gallon of each standard color and 1 gallon of each accent color.
2. All materials shall be in 1 gallon containers, tightly sealed and clearly marked with manufacturers name, color number or formula, base number and sheen.

B. Removal: Remove all trash, empty cans, solvents and all painting related materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Diamond Vogel.
3. The Glidden Company.
4. ICI Paints.
5. KWAL-Howells, Inc.
6. PPG Industries.
7. Sherwin-Williams Company.
8. Substitutions must be pre-approved by UCB Project Manager and UCB paint shop. Any proposed substitution must be available in the Boulder Metro area.

2.2 MATERIALS

A. Quality:

1. Provide the best quality Contractor grade or better of the various types of coatings as regularly manufactured by acceptable paint material manufacturers.
2. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Waterborne or latex acrylic coatings shall be used unless prior approval for substitution is obtained.

C. Materials Safety Data Sheets and technical product data sheets must be included with operation and maintenance manuals for all products used.

D. Specialty Paints and Paint Systems: All specialty products should be included in review documents or specifications. Facilities Operations Pain Shop should be consulted for application solutions to best meet the need and be consistent with similar Campus coatings. Examples to include but not limited to: Floor coatings, High heat and Chemical Resistant coatings, Specialty Metal coatings, etc.
2.3 VOLUME SOLID CONTENTS

A. When applied at a rate of 400SF per gallon-obtaining a MIL thickness when dry of a minimum of 1.3 MILS, the minimum acceptable Volume Solid Content must be A (see list below) minimum and angular specular sheen should be B (see list below):

1. Flat Finish:
   a. A: 38%.
   b. B: 0-5 @ 60°.

2. Eggshell or Satin Finish:
   a. A: 36%.
   b. 16-32 @ 60°.

3. Semi-Gloss:
   a. 34%.
   b. 30-60 @ 60°.

4. Gloss Finish:
   a. 34%.
   b. 60-80 @ 60°.

B. 85% sheen measurement is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

   1. Beginning coating application constitutes Subcontractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulates.

   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. For all paint finishes:
   1. New surfaces shall have 1 primer coat and 2 finish coats.
   2. Existing surfaces shall have minimum 2 finish coats.
   3. If sprayed, all walls except mechanical rooms, storage areas, closets and ceilings, must be backed rolled on final coat.
   4. All paint shall meet The University of Colorado at Boulder Architectural Standards, Version 2009 or current, sheen rating of 16 – 32 measurement at 60° F, and volume solid’s ratings.
   5. Patch painting will not be acceptable, total affected areas shall be painted. Terminate painting only at corners or joints.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

A. Areas requiring specific paint finish are as follows:
   1. Elevator, Mechanical and Electrical Room Painting:
      a. Walls and Ceilings: Off white acrylic latex semi-gloss.
      b. Floors (Elevator and Electrical Rooms Only): Light grey waterborne floor finish.
   2. Baseboard Radiation Covers:
      a. Area Inside Metal Covers: Paint flat black or appropriate color to match.
   3. Access Flooring:
      a. Space Beneath Floor Surface: Paint flat black or appropriate color to match.
   4. Wall and Ceiling Return Air Grilles:
      a. Space Behind Grilles: Paint flat black for a distance of 24 inches from face of grille or appropriate color to match.
   5. Non-Galvanized Iron Pipes: Color to match background.
   6. Roof, Wall, or Ground Mounted Equipment: Color approved by UCB Staff.

B. For all paint finishes:
   1. New surfaces shall have 1 primer coat and 2 finish coats.
   2. Existing surfaces shall have minimum 2 finish coats.
   3. If sprayed, all walls except mechanical rooms, storage areas, closets and ceilings, must be backed rolled on final coat.
4. All walls must be painted with a paint that meets CU’s sheen standards for the 16-32 measurement at 60°, and volume solid’s ratings.

5. All trim is to be painted with semi-gloss paint that meets CU’s sheen and volume solids ratings.

6. Patch painting will not be acceptable, total affected area shall be painted. Terminate painting only at corners or joints.

END OF SECTION 099123
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of wood finishes on interior substrates as indicated on Drawings.

B. Related Sections include the following:

1. Division 06 Section “Interior Architectural Woodwork” for wood species and cut for exposed surfaces to receive finishing.
2. Division 08 Section "Flush Wood Doors" field finishing wood doors.
3. Division 09 Section "Interior Painting" for surface preparation and application of standard paint systems on interior substrates.

1.2 SUBMITTALS

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

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.

1.3 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."

B. Mockups: Apply benchmark samples of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
   b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on benchmark samples.
   a. If preliminary stain color selections are not approved, apply additional benchmark samples of additional stain colors selected by Architect at no added cost to Owner.
1.4 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

B. Stain Colors: As selected by Architect from manufacturer's full range.

2.2 WOOD FILLERS

A. Wood Filler Paste: MPI #91.

2.3 PRIMERS AND SEALERS

A. Wood Preservative: MPI #37.

B. Alkyd Sanding Sealer: MPI #102.

C. Lacquer Sanding Sealer: MPI #84.

D. Shellac: MPI #88.

2.4 STAINS

A. Interior Wood Stain (Semitransparent): MPI #90.

2.5 VARNISHES

A. Interior Varnish (Flat): MPI #73, Gloss Level 1, alkyd type.

B. Interior Varnish (Semigloss): MPI #74, Gloss Level 5, alkyd type.

C. Interior Varnish (Gloss): MPI #75, Gloss Level 6, alkyd type.
2.6 POLYURETHANE FINISHES
   A. Two-Component Aliphatic Polyurethane (Clear): MPI #78.
   B. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.
   C. Interior, Oil-Modified, Clear Urethane (Gloss): MPI #56, Gloss Level 6.
   D. Moisture-Cured Clear Polyurethane (Flat): MPI #71, Gloss Level 1.
   E. Moisture-Cured Clear Polyurethane (Gloss): MPI #31.

2.7 WATERBORNE ACRYLIC FINISHES
   B. Waterborne Clear Acrylic (Semigloss): MPI #129, Gloss Level 5.
   C. Waterborne Clear Acrylic (Gloss): MPI #130, Gloss Level 6.

2.8 LACQUERS
   A. Lacquer (Clear Flat): MPI #87, Gloss Level 1.
   B. Lacquer (Clear Satin): MPI #85, Gloss Level 4.

2.9 OIL FINISH
   A. Danish Oil: MPI #92.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and conditions, with Applicator present, for compliance with requirements
      for maximum moisture content and other conditions affecting performance of work.
      1. Maximum Moisture Content of Wood Substrates: 15 percent when measured with an
         electronic moisture meter.
      2. Verify compatibility with and suitability of substrates, including compatibility with existing
         finishes.
      3. Begin finish application only after unsatisfactory conditions have been corrected and
         surfaces are dry.
      4. Beginning application of finish system constitutes Contractor's acceptance of substrate
         and conditions.
3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.3 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Finish Carpentry Substrates:

1. Polyurethane Varnish Over Stain System: MPI INT 6.3E.
   b. Three Finish Coats: Interior, oil-modified, clear urethane (satin).

B. Exposed Wood Panel-Product Substrates:

1. Polyurethane Varnish Over Stain System: MPI INT 6.4E.
   b. Three Finish Coats: Interior, oil-modified, clear urethane (satin).

END OF SECTION 099300
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes identifying devices for interior signs.

1.2 SYSTEM DESCRIPTION

A. Interior signs: Provide interior room signs to accomplish the following functions:
   1. Room number signs.
   2. Two nameplate holders per room.
   3. Directional signs.
   4. Accessibility signage.
   5. Code required signage.
   6. Maximum occupancy signage for classrooms and assembly areas.
   8. Building directory, where applicable.

1.3 SUBMITTALS

A. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop drawings showing fabrication and erection of signs. Include plans, elevations showing mounting heights from floor level, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

   1. Provide a signage schedule for each floor level.
   2. Provide message list for each sign required, including large-scale details of wording and lettering layout.
   3. Furnish location template drawings for items supported or anchored to permanent construction.

      a. Furnish full-size spacing templates for individual building-mounted letters and numbers.

C. Samples: Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics.

   1. Submit full-size template sample unit. Acceptable units may be installed as part of the Work if approved by the Architect.

      a. Manufacturer's color charts consisting of actual sample sections of material including the full range of colors available for each material required.


D. Maintenance Data: For signs to include in maintenance manuals.
1.4 QUALITY ASSURANCE

A. ADA Requirements: Provide interior signage in compliance with “Title III of the Americans with Disabilities Act (ADA)” for handicapped accessibility requirements. Building signage identifying permanent rooms and spaces, provide with “Grade 2 Braille” and letters raised minimum of 1/32-inch.

1. Fabricate signs to meet ADA Accessibility Guidelines (ADAAG) and the Uniform Federal Accessibility Standards (UFAS) as required.
2. Fabricate signs to comply with the University of Colorado Boulder Campus Facilities Identification System guidelines.

B. Certificate of Occupancy Requirements: Provide interior signage for all permanent rooms and spaces on each floor levels as required by the local building officials for Certificate of Occupancy.

C. Manufacturer: For each sign form and graphic image process indicated furnish products of a single manufacturer with a minimum of three (3) years experience in the types of signs required.

D. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

1.5 COORDINATION

A. Coordinate final accepted amount of interior signage required for each floor level with the Owner's Representative.

1.6 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Panel sign Materials: Provide the following materials as manufactured by New Hermes or approved substitute:

1. General Signage: Gravoply.
2. Raised Lettering and Braille Signage: Gravo-Tac 2-ply system.

B. Vinyl Film: Provide opaque nonreflective vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior as well as interior applications.

D. Other Materials: Other approved materials for specific designated uses shall be approved by the Campus Architect.

D. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
E. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

F. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

G. Accessories:
   1. Mounting Tape: Heavy Duty 1 inch by 1 inch mounting squares by 3M or approved substitute.
   2. Fabricate brackets and fittings for bracket mounted signs from extruded aluminum to suit sign panel construction and mounting conditions.

2.2 PANEL SIGNS

A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

B. Interior Room Signs:
   1. Fabricate white plastic room signs with edges mechanically and smoothly finished with square cut edges and 3/8 inch radiused corners. Sign face shall be edged with a recessed 1/8 inch border.
      a. Size: 6 inch by 6 inch for room number signs and directional signs.
      b. Letters shall be black in color and in the Helvetica Medium letter style raised from the background not less than 0.03125 inches thick as required by ADAAG.
      c. Provide 1.125 inch letter height for room numbers, centered 2 inches from top of the letter of the top of the sign. Canter a ½ inch wide black Braille lettering panel 3/8 inch from the bottom of the sign.
      d. Provide raised copy and recessed Braille lettering in copy thickness not less than 0.03125 inches thick as required by ADAAG.
   2. Fabricate inserts for occupant use.
      a. Size: 1 inch by 6 inch open-ended horizontal sleeve.
      b. Provide a blank white 90 lb. card stock insert covered with a clear acrylic matte strip 0.625 inches (1/16") thick.
      c. Where required for informational signage, provide 6 inch by 6 inch black anodized insert sleeve open at the top.
      d. Provide a blank white 90 lb. card stock insert covered with a clear acrylic matte strip 0.625 inches (1/16") thick for a 6 inch by 6 inch insert sleeve.
   3. Fabricate white plastic directional signs with edges mechanically and smoothly finished with square cut edges and 3/8 inch radiused corners. Sign face shall be edged with a recessed 1/8 inch border.
a. Size: 6 inch by 6 inch surface-mounted signs that may be arranged one over the other, or side by side, as necessary to carry the message.
b. Provide upper and lower case black vinyl die-cut letters in the Helvetica Medium letter style.
c. Provide black vinyl die-cut left, right, up, or down arrows as required.

C. Handicapped Accessibility Signage:
   1. Provide symbol for handicapped access on signage designating those areas accessible for the handicapped in conformance with the Society for Environmental Graphic Designers (SEGD) recommendations for accessible signage, most recent edition.

2.3 METAL LETTERS AND NUMBERS

A. Metal letters and numbers mounted on vertical surfaces are not recommended and shall not be used without special permission from the Campus Architect.

2.4 FACTORY FINISHES

A. Colors and Surface Textures: Provide colors as selected by Architect and user which are acceptable to Campus Architect.

B. Metal Finishes: Comply with NAAMM “Metal Finished Manual” for finish designations and application recommendations.

C. Aluminum Finishes: Class II, Clear Anodized Satin Finish. AA-M31C21A31 (fine satin mechanical finish; chemical etch, fine matte; 0.4 mil minimum thick anodic coating).

2.5 LIFE SAFETY SIGNAGE

A. Provide surface-mounted signs as specified above and as required by applicable Building Code and Fire Department regulations for life safety which may include stair and exitway doors, areas of refuge, elevator lobbies, elevators, fire command center and standpipe valve cabinets.

   1. Provide signs, 12 inch by 12 inch on stairwell side of each stairwell door, at each floor for buildings four stories or more in accordance with the provisions of the 1997 Uniform Building Code.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

   1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
B. Interior Signs:
   1. Surface-Mounted Units: Attach signs to wall surfaces using mounting tape squares in each corner of the sign except at each top corner and one centered at bottom of sign for 6 inch by 6 inch units.
   2. Bracket-Mounted Units: Not permitted except with special permission from the Campus Architect.
   3. Locate surface-mounted signs on the wall adjacent to the latch side of the door (or the nearest adjacent wall) at 60 inches above the finished floor from the centerline of the sign (any size) and out of the swing of the door,. Mount signs with right edge 4 inches from the inside face of the door jamb.
   4. Locate surface-mounted insert sleeves centered below the room sign in multiples as necessary, each spaced 1 inch apart.

C. Vinyl Film:
   1. Apply vinyl film letters without wrinkles or distortions. Provide template to establish letter spacing.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 101400
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Partitions for toilet cubicles.
   2. Urinal screens.
   3. Hardware.

1.2 REFERENCES

B. Uniform Federal Accessibility Standards (UFAS).

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures.
   4. Show overhead support or bracing locations.
C. Samples: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.
   1. Minimum 3 by 6 inch samples of actual base metal.
D. Product Certificates: For each type of toilet compartment, from manufacturer.
E. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.
B. Installer Qualifications: Three years experience in installation of metal toilet partitions.
1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Accurate Partitions Corp.
2. General Partitions Manufacturing Corp.
3. Global Steel Products Corp.
4. Hadrian.
5. Knickerbocker Partition Corp.
6. Metpar Corp.
7. Sanymetal Division of Crane Plumbing Co.
8. Weis/Robart Partitions, Inc.

2.2 MATERIALS

A. Toilet-Enclosure Style: Floor mounted, overhead braced.

B. Urinal-Screen Style: Wall anchored.

C. Sheet Steel for Baked Enamel Finish: ASTM A 591; Class C, galvanized-bonderized steel, of the following thicknesses:

1. Panels and Screeds: 20 gauge.
2. Doors: 22 gauge.
4. Reinforcement: 12 gauge.

D. Partitions, Screen, and Door Dimensions: Not less than 1 inch thick units. Pilasters 1-1/4 inch thick.

1. 24 inch wide doors.
2. 32 inch wide (clear opening), swing out doors at stalls for use by handicapped. Conform to ANSI A117.1.
3. Urinal stall width: 30 inches. Conform to ANSI A117.1 and UFAS requirements.

E. Provide doors on all stalls.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Hinges: Surface mounted type, or cutout inset type adjustable to hold door open at an angle up to 90 degrees, set to hold door open 15 degrees when not occupied. Provide spring loaded, gravity type pivots, or spring action cam type to comply with manufacturer's recommendations.

2. Latch and Keeper: Manufacturer's standard heavy-duty recessed latch unit, with combination rubber faced door strike and keeper. Latch shall be slide type; twist type not acceptable. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mounted 14 inches below top of door.
   a. Provide additional coat hook inside handicapped type stalls.

4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

5. Door Pull: Manufacturer's standard wire type unit at out-swinging doors that complies with regulatory requirements for accessibility. Knob type not acceptable. Provide units on both sides of doors at compartments designated as accessible.

2.4 ANCHORING AND FASTENING

A. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

D. Overhead Bracing: Manufacturer's standard continuous, head rail with antigrip profile and in manufacturer's standard finish.

E. Provide theft-resistant fasteners for all accessory mountings.

F. Provide concealed reinforcement for installation of hardware, fittings, brackets, and required accessories.

G. Provide concealed fasteners wherever possible.

H. Secure partitions to walls with a minimum of two stirrup brackets attached near top and bottom of the partitions.

I. Coordinate brackets with wall tile to ensure an even substrate for anchorage.

2.5 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

2.6 FINISH

A. Prime with baked on, rust inhibitive primer and apply two coats of baked enamel to provide 1.5 mil minimum dry film thickness.

B. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking.
   1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch (13 mm).
      b. Panels and Walls: 1 inch (25 mm).

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

E. Clearances:
   1. Between Pilasters and Panels: Not more than 1/2 inch.
   2. Between Panels and Walls: Not more than 1 inch.
3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113
PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:
   1. Toilet and bathroom accessories.
   2. Items provided by the Owner for installation by the Contractor.

1.2 REFERENCES

B. Uniform Federal Accessibility Standards (UFAS).
C. Appendix 2 of UCB Standards.

1.3 SYSTEM DESCRIPTION

A. Provide mirrors over lavatories.
   1. Single Lavatory: Mirrors shall be a minimum of 18 by 36 inches.
   2. Two Lavatories: 30 by 36 inches.
   3. Three or More Lavatories: Gang type mirror, 36 inches high and approximate length of lavatory run.
   4. Full Length Wall Mirror: Viewable from wheel chair; not necessarily at lavatory.

B. Mount a small article shelf just below the mirror.
   1. Gauge: 18 gauge stainless steel with raised from and back edges.
   2. 6 inches wide, mounted 1 inch out from the wall to facilitate cleaning.
   3. Mount on stainless steel brackets bolted to wall.

C. Install bookshelf in each toilet room.
   1. Minimum Length: 24 inches minimum with 12 inches added for each lavatory over one, 12 inches deep minimum.
   2. Toilet room with four lavatories would have 60 inches of bookshelf.
   3. Bookshelf shall be made of stainless steel with stainless steel brackets bolted to wall.

D. Install sanitary napkin disposals in wall or between toilet compartments in Women’s Restrooms. Install in the partition wall where applicable to be shared between stalls.

E. Install roll towel dispensers in all restrooms and other locations as appropriate.

F. Install splash guards on all walls adjacent to mop sinks in Custodial Work Stations, to faucet height.
G. Install mop and broom holders in each Custodial Work Station with six holders and five hooks. Mount to that two mop holder will occur over mop sink. Install locker in custodial workstations per Appendix 2.

H. Install two double roll toilet paper dispensers to accommodate four rolls of toilet paper per each ADA stall.

I. Install Georgia Pacific Jumbo or Compact coreless toilet paper dispenser in each regular stall.
   1. Mounting Heights:
      a. Top of Mirrors: Conform to UFAS requirements.
      b. Small Articles Shelf: Conform to UFAS requirements.
      d. Soap Dispensers: 9 inches clear above lavatories. Conform to UFAS requirements.
      e. Towel Cabinets: Conform to UFAS requirements.

J. Install single locker in each custodial workstation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Conform to requirements of ANSI A117.1 and UFAS for making facilities and accessories accessible to and usable by the physically handicapped.

B. Conform to requirements of ASTM F 446 for grab bars and accessories for test methods, anchorage and functional performance.

C. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas, unless otherwise acceptable to the Architect.
D. Stamped names and labels on exposed faces of units will not be permitted, except where otherwise indicated.

E. Provide locks where indicated, with the same keying for each type of accessory unit in the Project wherever possible. Furnish two keys for each lock to Facilities Management’s Environmental Services office.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION
A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY
A. Special Mirror Warranty: Manufacturer’s standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Stainless Steel: ANSI Type 302/304 with polished No. 4 finish, 22 gauge minimum.

B. Sheet Steel: Cold-rolled complying with ASTM A 366, 20 gauge minimum. Provide surface preparation and metal pretreatment as required for applied finish.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

D. Mirrors: ASTM C 1036, Type I, Class 1, Quality q2, 0.25 inch thick, with silvering, electro-plated copper coating, and protective organic coating.

2.2 OWNER PROVIDED ITEMS
A. Jumbo Toilet Paper Dispenser:
   1. Public and Classroom Areas: Georgia-Pacific Jumbo or Coreless roll dispensers.
   2. A minimum of three weeks advanced notice is required to obtain these dispensers. Provided by Owner, Contractor to install.
3. Keys to each dispenser must be turned over to Environmental Services Office – Stadium 1B16, Campus Box 53.

B. Roll Towel Dispensers:
1. Restrooms: Georgia Pacific Coromatic roll towel dispensers.
2. A minimum of two weeks advance notice is required to obtain these dispensers. Provided by Owner, Contractor to install.
3. Keys to each dispenser must be turned over to Environmental Services Office – Stadium 1B16, Campus Box 53.

C. Foam Hand Soap Dispensers:
1. Restrooms: GoJo Hand Foam Soap Dispensers: GoJo Green foam hand soap or regular foam hand soap.
2. A minimum of three weeks advance notice is needed in order for Owner to supply.
3. Must be installed with screws, not adhesive tape.
4. Refer to Division 01 and Appendix 2 for environmental service requirements.

D. Hand Sanitizer:
2. Building entryways or other areas on campus where there is limited access to water supply.
3. Prior approval by the “Hand Sanitizing Committee” is require.
4. Must be installed with screw, not adhesive tape.
5. Refer to Division 01 and Appendix 2 for environmental service requirements.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING
A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
B. Remove temporary labels and protective coatings.
C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire protection cabinets for portable fire extinguishers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches (150 by 150 mm) square.

E. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

F. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.4 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Glazing: Clear acrylic.

C. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following manufacturers:
   b. Larsen's Manufacturing Company.
   c. Modern Metal Products by Muckle.
   d. Potter Roemer Division of Smith Industries, Inc.

B. Mounting: Recessed or semi-recessed whenever possible, or as indicated on the Drawings.

C. Style: As selected by the Architect and approved by the Owner (rounded corners preferred).

D. Cabinet Construction: Fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

E. Cabinet Material:

1. Minimum 20 gauge, commercial quality, cold rolled steel, corners mitered and welded, with white baked enamel finish.
2. Shelf: Same metal and finish as cabinet.

F. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box.

G. Semirecessed Cabinet: One-piece trim and door design with full glass door, with continuous piano hinge and tempered glass glazing, interior capacity sufficient for one 10-lb fire extinguisher, manufacturer's standard white baked enamel finish.

H. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide manufacturer's standard pull handle with roller catch.
   2. Provide continuous hinge, stainless steel, permitting door to open 180 degrees.

J. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
   3. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
   4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
      a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         3) Lettering Color: White.
         4) Orientation: Vertical.

K. Finishes:
   1. Manufacturer's standard baked-enamel paint for the following:
      a. Exterior of cabinet, door and trim except for those surfaces indicated to receive another finish.
      b. Interior of cabinet.
   2. Steel: Baked enamel or powder coat.

2.3 FABRICATION
A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
   3. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling"

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for hose valves, racks and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Install in locations and at mounting height required by applicable codes.
C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
   2. Provide inside latch and lock for break-glass panels.

D. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING
A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets
   are installed unless otherwise indicated in manufacturer's written installation instructions.
B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking
   devices operate properly.
C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as
   recommended by manufacturer.
D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-
   finished appearance. Use only materials and procedures recommended or furnished by fire
   protection cabinet and mounting bracket manufacturers.
E. Replace fire protection cabinets that have been damaged or have deteriorated beyond
   successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413
PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 SUBMITTALS
   A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
   B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.
   C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
   D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE
   A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
   B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS
   A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Larsen's Manufacturing Company.
      c. Modern Metal Products by Muckle.
      d. Potter Roemer Division of Smith Industries, Inc..

   2. Valves: Manufacturer's standard.
   3. Handles and Levers: Manufacturer's standard.
   4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
5. Class: 4A:60B:C; UL approved.

B. Multipurpose Dry-Chemical Type: UL-rated 10 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container; with pressure indicating gauge.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

B. Color: Red.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.


PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

   1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
   2. Unless otherwise required, mount top of fire extinguisher at 5 feet above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes horizontal louver blinds.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long.

D. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Product Standard: Unless otherwise indicated, comply with WCMA A 100.1.

PART 2 - PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS

A. Provide blinds to match existing blinds at all perimeter windows.

B. Colors, Textures, Patterns, and Gloss: As selected by Architect and approved by Owner.

C. Fabrication: Comply with AWCMA Document 1029 unless otherwise indicated.

1. Fabricate concealed components from noncorrodible or corrosion-resistant-coated materials.

2. Provide lifting and tilting mechanisms with permanently lubricated moving parts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION

A. Install blinds level, plumb, and located not closer than 2 inches (51 mm) to interior face of glass.
   
   1. Flush Mounted: Install blinds with louver edges flush with finish face of opening when slats are tilted open.
   2. Jamb Mounted: Install headrail flush with face of opening jamb and head.
   3. Head Mounted: Install headrail on face of opening head.
   4. Recessed: Install headrail concealed within blind pocket.

B. Adjust horizontal louver blinds to operate smoothly and easily throughout entire operational range.

3.3 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 122113
PART 1 GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Contract drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. If inconsistency exists, the most restrictive requirement shall be applied as determined by the Engineer.

1.2 SUMMARY
A. This Section includes fire-suppression piping and equipment for the following building systems:
   1. Wet-pipe, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers.
B. Work included in this section shall include all materials and labor, both directly required and incidental, as necessary to modify an existing fire sprinkler system as shown on the drawings.
C. Related Sections include the following:
   1. Division 1
D. Contractor shall be responsible to obtain permits from the primary AHJ. All submittals and inspections shall be coordinated through the primary AHJ. All requirements of the primary AHJ are to be complied with in addition to these specifications.

1.3 REFERENCES
A. The following codes and standards shall be followed for the design and installation of the fire protection system.
   1. Colorado Department of Public Safety, Division of Fire Safety
   2. Colorado Cross-Connection Control Manual
   8. UL Fire Resistance Directory
B. DEFINITIONS
   1. AHJ: Authority Having Jurisdiction – The UCB Fire- and Life-Safety Group is the AHJ for the project.
   2. Contractor – When used within this Section, the firm responsible for preparation of shop drawings and installation of the fire protection system.
   3. FACP – Fire Alarm Control Panel
   4. FM – Factory Mutual
   5. CPVC - Chlorinated polyvinyl chloride plastic
   7. Owner – University of Colorado at Boulder
8. UL – Underwriters Laboratories
9. Working Plans – Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 and NFPA 14 for obtaining approval from authorities having jurisdiction.

PART 2 SUBMITTALS

2.1 GENERAL REQUIREMENTS

A. Contractor shall not proceed with purchasing, fabrication, or installation of submittal related work until notified in writing. Re-submit as required until so marked by the Engineer. Work that is executed without required prior acceptance by the Engineer and AHJ’s shall be submitted to rejection. Removal and reconstruction of rejected work shall be at the Contractor’s expense.

B. Submittals shall be submitted to the Owner, AHJ and the Engineer at the same time. The Owner reserves the right to charge the Contractor for multiple reviews by the University or Engineer if more than two submittals are required for acceptance.

C. The submittal shall include product data, working drawings, hydraulic calculations, and fire-hydrant flow test report. Partial submittals shall not be acceptable.

D. The shop drawing submittal shall be submitted for review within 45 days of notice to proceed.

E. Review by the Engineer shall not relieve the Contractor from full compliance with the requirements of the contract documents, codes, and standards.

F. Completed State of Colorado Plan Registration Form shall accompany the shop drawing submittal.

2.2 PRODUCT DATA

A. Product data shall contain annotated descriptive data to show the specific model, type and size of each item the Contractor proposes to furnish.

B. Catalog cut sheets shall be submitted in a suitable folder or binder and indexed referencing the applicable specification section. Unclear or partial reproductions of manufacturer’s original catalog cut sheets or descriptive data shall not be acceptable.

C. Each item supplied shall be clearly identified on each sheet. Where the submitted material describes items not intended to be provided, the additional items shall be crossed out and the submittal item shall be identified.

D. Contractor shall submit product data for all equipment to be provided for the project including the following:
   1. Pipe and fitting materials and methods of joining.
   2. Pipe hangers and supports.
   3. Valves, including specialty valves, accessories, and devices.
   4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.

2.3 SHOP DRAWINGS

A. Contractor shall provide working drawings for review that include all information required by NFPA 13.

B. Drawings shall be of any size adequate to demonstrate the required modifications to the system. Minimum scale shall be 1/8” = 1’-0”.

C. Contractor shall include details and sections as required to clearly define and clarify the design.
D. Drawings shall be in strict compliance with NFPA 13 and drawn on computer to a commercial or architectural/engineering drawing standard. Computer drawings shall be full scale and be plotted to a noted scale.

E. Contractor shall be responsible for acquiring any general arrangement drawings depicting the building layout, overall site plan and the detailed building drawings, as necessary to develop complete submittals. Reference drawings for the existing building may be obtained from the Owner if available; Contractor is to verify such availability prior to bidding.

F. An up-dated set of shop drawings approved by the AHJ that incorporate all field changes shall be maintained at the job site, in good condition from the start of construction until all inspections are completed.

2.4 AS-BUILT DRAWINGS

A. Submit as-built drawings to the Engineer and the AHJ for review and acceptance. The submittal to the Owner shall include one set of blue prints and one set of reproducible. The as-built submittal shall include all the information required under the shop drawings. The as-built drawings shall show the system as installed, including all deviations from the approved shop drawings.

B. Dependent upon the extent of field changes required to the original approved shop drawings, the Engineer and the AHJ reserve the right to require a supplemental set of hydraulic calculations, at no additional cost to the Owner to verify the adequacy of the system in the as-built condition.

C. Submittal of the as-built drawings shall be submitted within 30 days upon completion of the sprinkler work. Contractor shall revise and resubmit as necessary to obtain Engineer and AHJ acceptance of the submittal.

D. Once the submittal is acceptable, the Contractor shall submit the final drawings on computer disk to the University. CAD files are to be formatted to the appropriate UCB format. The Contractor shall provide all font files necessary to open and clearly read the drawings.

2.5 HYDRAULIC CALCULATIONS

A. The “Small Room Rule” may be used for the new rooms in accordance with NFPA 13.

B. Hydraulic calculations are not required as long as the contractor maintains a pipe schedule consistent with the existing design. Specifically, the grid system shall be maintained and not more than two sprinklers shall be supplied from any single outlet on the grid branch lines.

PART 3 QUALITY ASSURANCE

3.1 CONTRACTOR QUALIFICATIONS

A. The entire fire protection system project including design, calculations, installation, and testing, excluding prefabrication, shall be bid by a single firm which has the capabilities to perform all of the required work. No installation work shall be sub-contracted without prior permission in writing from the AHJ.

B. The Contractor shall be registered as a “Fire Suppression Contractor” in the State of Colorado.

C. The Contractor shall have a minimum of five years of experience in the design and installation of similar projects of comparable size and value in the State of Colorado. Contractor shall, upon request, provide list of previous projects including point of contact.

D. The Contractor shall have emergency service capability for response to emergency conditions.

E. The Contractor shall have an established office within one hundred miles of the University of Colorado Boulder Campus, which maintains a full complement of spare parts, tools, and equipment.

3.2 DESIGNER QUALIFICATIONS

A. The design of the fire protection system shall be performed by or under the direction and control of a Colorado registered P.E. or a NICET level III. Said professional shall be experienced in fire protection. Colorado registered professional engineer who are “Members” in the national organi-
zation of the Society of Fire Protection Engineers (SFPE) or meet the qualifications for the grade of "Member" in SFPE are preferred.

B. The Owner, Engineer, and AHJ reserve the right to request proof of qualifications.

C. No design related work shall be subcontracted or performed by persons other than bona fide employees working solely for the Contractor. Any exception shall be pre-approved by the Engineer in writing.

3.3 INSTALLATION QUALIFICATIONS

A. Welders shall comply with the requirements of AWS D10.9, "Specifications of Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3". Welding shall not be performed on-site.

B. Job foreman shall be trained for the installation and operation of each type of system and possess documentation of qualifications and training. Foreman shall have a minimum of three years successful installation experience on projects with fire protection systems similar in scope and nature to that required for this project.

3.4 EXTRA MATERIALS

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

B. Sprinkler Cabinets: Finished, new wall-mounted steel cabinets with hinged cover at existing main riser, with space for all required spare sprinklers plus sprinkler wrench. Provide 10% spare sprinklers for the project, but not less than one or more than six spare sprinklers for each type sprinkler. Provide wrench for each type sprinkler used on the project.

PART 4 PRODUCTS

4.1 MANUFACTURERS

A. Equipment used shall bear UL listing or FM approval for the use intended and be permitted by applicable referenced standards.

B. All components shall be capable of producing piping systems with 175-psi minimum working-pressure rating, unless otherwise indicated.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grooved Mechanical Couplings (shall be greaseless type):
   - Victaulic Company of America
   - Grinnell
   - Central

2. Sprinklers:
   - Viking Corp.
   - Globe
   - Reliable

4.2 PIPES AND TUBES

A. All piping shall be USA manufactured Schedule 10 or 40 pipe for 2 ½" and larger and schedule 40 for all pipe 2" and smaller. For 2" and smaller pipe, threadable thinwall pipe may be used only if the threaded Corrosion Resistance Ratio is greater than or equal to 1.0.

B. Galvanized pipe shall be provided where required by this Section.
C. Steel pipe shall comply with the following:
   2. Thinwall, Threadable Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10.

D. Copper Tube: Not allowed.

E. CPVC Pipe: Not allowed.

4.3 PIPE AND TUBE FITTINGS

A. All pipe 2” and smaller shall have threaded fittings. Exceptions to this requirement include locations where unions would be required, grooved fittings may be used in place of unions. Also, gridded branchlines may have grooved fittings. Threaded fitting shall be either malleable or cast iron. For 2 ½” and larger pipe, all fittings shall be ductile iron grooved fittings.


E. Steel, Grooved-End Fittings: UL-listed and FM-approved, ASTM A 47, malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.


G. Wrought-Copper Fittings: ASME B16.22.


I. Copper, Grooved-End Fittings: ASTM B 75, copper tube or ASTM B 584, bronze castings. Fittings may be copper tube with ends factory or field expanded to steel-pipe OD.

J. Copper, Mechanically Formed Tees: Manufacturer's standard written procedure for forming T-branch outlets with UL 45-listed tools.

K. Segmented welded fittings shall not be allowed.

L. Face bushings and hexagonal bushings shall not be allowed.

M. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

4.4 GENERAL-DUTY VALVES

A. Ball drip valves: Brass with ½” NPT rated for 175 psi operating pressure.

B. Inspector’s test valves: 1” brass ball valves.

C. Main and sectional drain valves: All bronze gate valves.

D. Approved combination test/drain valves may be installed.

E. The valves used for the gage assemblies shall be ¼” globe or angle 3-way valves, with a working pressure of not less than 175 psi. They shall have a screwed bonnet and renewable composition disk.

4.5 FIRE-PROTECTION-SERVICE VALVES

A. Not Required.
4.6 SPECIALTY VALVES
   A. Not Required.

4.7 SPRINKLERS
   A. Sprinkler Types and Categories: The same model, manufacturer and orifice size shall be used throughout the project.
   B. New sprinklers shall match existing to the degree feasible including orifice size, make, model, style, and escutcheon.
   C. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Plastic sprinkler escutcheons shall not be used. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
      1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
      2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
      3. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

4.8 SPECIALTY SPRINKLER FITTINGS
   A. Specialty Fittings: UL listed and FM approved; made of steel, ductile iron, or other materials compatible with piping.
   B. Groove Mechanical-T Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlet.
   C. Grooved Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.
   D. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.
   E. Sprinkler, Drain and Alarm Test Fittings: UL-listed, cast- or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

4.9 ALARM DEVICES
   A. Not Required.

4.10 PRESSURE GAGES
   A. Water Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch diameter dial with dial range of 0 to 250 psi in 5 psi increments.

4.11 BACKFLOW PREVENTERS
   A. Not required.

PART 5 EXECUTION

5.1 PREPARATION
   A. Contract drawings are diagrammatic in character and do not necessarily indicate every offset, fitting, or dimension.
   B. Contract documents shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurements, Contractor shall take necessary measurements and prepare the drawings.
   C. Before any work is installed, Contractor shall verify that equipment will properly fit the space. Verify that required piping grades can be maintained without interferences between systems, structural elements, or with the work of other trades.
   D. To the extent possible, the contractor should offset the new system such that the existing sprinkler system may remain in place. Existing system is to be demolished when the new installation is
fully complete. Contractor should ensure that the new system does not prevent proper coverage provided by the existing system.

E. Coordinate the installation of fire protection materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.

F. Verify all dimensions by field measurements.

G. Sequence, coordinate, and integrate installations of fire protection materials and equipment for efficient flow of work.

H. Where mounting heights are not detailed or dimensioned, Contractor shall install overhead fire protection services and equipment to provide the maximum headroom spaces. Notify the Engineer and the Owner of any condition where headroom of less than 7'-4" will result.

I. Install fire protection equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnection and to allow minimum interference with other installations.

J. All equipment is to be installed in accordance with manufacturer’s recommendations.

5.2 OUTAGE PROCEDURES

A. Fire suppression system outages of existing systems shall be minimized to the extent practicable. Outages shall not be requested from the Owner until the shop drawings are approved and all necessary materials are on site.

B. Outages shall be limited to a single day (i.e., no overnight outages are allowed).

C. All outages shall be coordinated with UCB Fire Systems Group.

D. Outages shall be limited to the effected floor. No outage is to occur that will result in a system outage of the 3rd floor fire suppression system.

5.3 EARTHWORK

A. Not applicable.

5.4 PIPING APPLICATIONS

A. Do not use welded joints with galvanized steel pipe.

B. Piping between Fire Department Connections and Check Valves: Use galvanized, Schedule 10 steel pipe with grooved fittings.

C. Fire-service-entrance piping: Refer to Division 2 Section "Water Distribution" if other materials are required.

5.5 VALVE APPLICATIONS

A. Rooms or enclosures housing sprinkler control valves shall be equipped with adequate heating, lighting and adequate clearance.

B. Control valves shall be accessible and operable from the floor unless otherwise shown on the contract drawings.

C. Where specific valve types are not indicated on the drawings, the following requirements apply:
   1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13 and NFPA 14.
   2. Control valves at main riser: Use gate valves.
   3. Control valves at sectional floor zones: Use butterfly valves
5.6 JOINT CONSTRUCTION

A. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer’s written instructions.

B. Steel-Piping, Threaded Fittings: Schedule 40 steel pipe shall have threaded fittings of either cast or malleable iron fittings.

C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use Clearflow Waterways for transitions between steel pipe and copper pipe.

5.7 WATER-SUPPLY CONNECTION

A. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping.

5.8 PIPING INSTALLATION

A. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Engineer before deviating from approved working plans.

B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

C. Piping shall be cleaned and kept clean and free of foreign matter before and during erection, including careful removal of dirt, scale, welding icicle or beads, cuttings, burrs and similar items.

D. Pipe with screwed fittings shall be made up with as few joints as possible. Screwed joints shall have clean machine-cut threads and shall be made up with a piping compound or Teflon pipe thread tape. The threads for open joints shall be cleaned and new piping compound or Teflon tape applied before remaking the joint.

E. Flange bolts and grooved couplings shall be evenly tightened with wrenches only. Flange bolts or grooved couplings that have been made up and broken shall be made with new, unused gaskets supplied with no cost added to the contract amount.

F. In cases where pipe sections are cut and removed on the job, the circular pipe section (coupon) shall be removed from the pipe and available for inspection at the time of hydrostatic test. After the hydrostatic test, the Contractor shall remove all coupons from the pipe.

G. Pipe outlets shall be reamed to remove burrs and sharp edges to the full interior diameter of the pipe.

H. The system riser shall not be attached to the supply connection until the underground piping is flushed, tested, and accepted by the AHJ.

I. Field changes in the piping layout or pipe size from the accepted drawings shall not be made without prior approval of the Engineer and the AHJ.

J. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

K. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections. Flanges are not required on piping installations using grooved joints.

L. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.

M. Install sprinkler piping with drains for complete system drainage in accordance with NFPA 13.

N. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
O. Install ball drip valves to drain piping between fire department connections and check valves.

P. Piping must be adequately supported and braced to withstand sudden loads caused by flow due to opening of hose connections or sprinklers or flow from fire department connection to system.

Q. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping and to NFPA 14 for standpipes.

R. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated.

S. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than ¼” and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

T. Piping shall be installed as tight to structure as feasible within the space.

5.9 VALVE INSTALLATION

A. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.

B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

D. Fire Hose Valves: Install no lower than 3'-6” and no higher than 5'-0” above finished floor.

E. Drain and Test Valves
   1. Auxiliary drains shall be provided as required by NFPA 13.
   2. Sight glasses shall be provided on all inspector's test connections where discharge cannot be seen while valves are operated.
   3. The inspector's test connection shall terminate at a forty-five degree elbow with a sprinkler that has the frame and strut assembly removed or with another restricted orifice listed for this purpose.
   4. All drains, except auxiliary drains, located inside the building, shall be piped to the outside of the building at a point free from causing water damage, terminating with a forty-five degree elbow.
   5. If discharge does not occur to concrete, Contractor shall supply and install a minimum 4’ long concrete splash block to direct the discharged water so as not to disturb adjacent landscape.

5.10 SPRINKLER APPLICATIONS

A. General: Use sprinklers consistent with the existing installation.

B. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces.

5.11 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical panels and tiles. For 2'x4' tiles, sprinklers shall be provided at the quarter-points of the tile at 1'-0” off of both grid lines.

B. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical panels.

5.12 LABELING AND IDENTIFICATION

A. Signs shall be permanently marked and constructed of weather-proof metal or rigid plastic.

B. Signs shall be secured to a device or the building wall with substantial and corrosion-resistant chains or fasteners.
C. Where sprinkler or standpipe control valves, test locations, or dry-pipe auxiliary drains are located in a room, above a ceiling, or in a concealed space, the location of the valve shall be indicated by a 2"x6" sign. Signs shall be located as follows:

D. If a valve is located inside a room, a sign shall be placed above the door tight to the door jam directly above the door handle. Similar signs are required on all intermediate doors within rooms.

E. If a valve is located above the ceiling, a sign shall be placed directly under the access panel or proper ceiling tile to access valve. Signs shall be tight to the ceiling.

F. In other locations, AHJ shall be contacted for specific direction of sign placement.

G. Signs used to identify the location of fire hose valves, in a closet, shall be a minimum of 1’x2’ and have letters with a 2” height and a ¼” stroke.

H. Valves
   1. All control, drain, and test connection valves shall be identified in accordance with NFPA 13.
   2. All main and sectional system control valves, including water supply control valves, shall have a sign indicating the portion of the system controlled by the valve.
   3. Where sprinkler piping is supplied by a system with more than one system riser, a sign shall be located at each feed connection to the combination system riser to identify that to isolate the sprinkler system served by the control valve, an additional control valve at other locations shall be shut off. The sign shall identify the location of the additional control valves.

I. Fire Department Connections
   1. Provide a sign having raised letters at least 1” in height cast on a plate or fitting indicating: “AUTO SPKR AND STANDPIPE”
   2. The FDC sign shall be of polished chrome.

J. The Contractor shall provide a sign identifying the design basis of a system as hydraulic calculated or pipe schedule at the main riser.

5.13 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers having paint or insulation overspray other than factory finish.

5.14 COMMISSIONING

A. Prior to requesting a final inspection and the Acceptance test, the Contractor shall:
   1. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
   2. Verify that specified tests of piping are complete.
   3. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
   4. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
   5. Fill wet-pipe sprinkler piping with water.
   6. Energize circuits to electrical equipment and devices.
   7. Adjust operating controls and pressure settings.
   8. Coordinate with fire alarm tests. Operate as required.
PART 6 TESTING REQUIREMENTS

6.1 GENERAL REQUIREMENTS
A. The AHJ shall witness all acceptance tests and inspections.
B. A minimum of three working days notice is required.
C. For cancellation of a test or inspection, at least 48 hours notice is required, or it shall be considered as a re-inspection. The Contractor shall be responsible for cost of re-inspections incurred by the AHJ.
D. Prior to the time of inspection, the Contractor shall verify that all equipment involved in the test are functioning and are placed as required by contract documents and shop drawings.
E. The Contractor shall supply all necessary equipment, such as ladders and special tools, required for the inspection.

6.2 RE-INSPECTIONS
A. If a system fails any of the above tests, the same scheduling procedure shall be followed.
B. If more than two tests are necessary, Contractor shall be responsible for any added costs incurred by the owner or Engineer.

6.3 ACCEPTANCE TESTS
A. The Contractor shall conduct the following tests for acceptance of the system installation. This includes all existing equipment that was reused in the system. Record the inspection on a copy of Material and Test Certificate shown in NFPA 13 or similar forms. The Contractor, prior to each inspection, shall complete test report information.
B. The Contractor shall perform all test and inspections with the AHJ present. A fire alarm representative shall be present when necessary to rest fire alarm devices connected to the fire sprinkler system.
C. Prior to any test on sprinkler/standpipe systems, the piping shall be flushed, in accordance with NFPA 13, to remove any foreign matter that could have entered the system during installation. The AHJ shall be contacted and allowed to witness the flushing.
D. Functional tests shall be preformed on all valves and manual operating devices.

6.4 SPECIFIC SYSTEM TESTS – WET SYSTEMS
A. Hydrostatic Test
   1. All piping, including all supply pipe to the fire department connection, shall be hydrostatically tested at 200 psi or 50 psi in excess of the maximum static pressure, which ever is greater. The minimum test duration shall be two hours with no visible leaks or drop in pressure. This test shall be conducted prior to concealing any piping. A complete installation inspection shall be conducted in conjunction with the hydrostatic test while all piping is exposed.
   2. If visual signs of leakage occur or the system looses pressure within the two hour test period, the test shall be considered as failed and shall require re-testing after correction of the cause of leakage.
B. Final System Inspection
   1. A final inspection shall be performed when the system installation is complete, which includes: a complete functional test of all system components and of all alarms via the inspector’s test connection.
   2. A complete installation inspection shall be conducted by the Engineer and the AHJ at the time of the final inspection that shall be coordinated with the work under section 16720.
3. A main drain test shall be conducted with the control valve wide open. The main drain valve shall be opened and remain open until the system pressure stabilizes.

6.5 WARRANTY

A. All materials and workmanship shall be warranted for a minimum period of one year beginning with the date of final acceptance by the Owner.

B. The Contractor shall be responsible during the design, installation, testing, and guarantee period for any damage caused by the Contractors or by defective work, materials, or equipment.

C. The Contractor shall be ultimately responsible to guarantee the system against freezing for reasons other than that of the building Owner’s negligence.

6.6 EMERGENCY SERVICE

A. During the installation and warranty period, the Contractor shall provide emergency repair service for the sprinkler system within four hours of the request by the Owner.

B. Service shall be available twenty-four hours per day, seven days per week.

6.7 DEMONSTRATION

A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.

B. Schedule demonstration with Owner with at least seven days' advance notice.

END OF SECTION 211300
PART 1 - GENERAL

1.01 SUMMARY

A. The University of Colorado at Boulder (UCB) Division 27 specifications are to be used for all UCB projects that involve Information Technology Services (ITS) or working within the existence of ITS infrastructure.

B. UCB ITS has the right to change and update these Division 27 specifications at any time without notice. Contractors and consultants shall make sure they are working with the latest addenda to these specifications.

C. These specifications are posted on the UCB Facilities Management website every year around July 1 however the document form and addenda files are only supplied from UCB ITS.

D. All related services and fees for moves, adds and changes to existing telecommunications station cabling are not covered by these specifications.

1.02 RELATED DOCUMENTS

A. The products and execution from these standards are the accepted practices from the ITS department and any products or execution outside these specifications will require written approval from ITS.

B. Drawings, contractor forms, conditions of the contract, construction manager/general contractor agreement exhibits and other division 1 specifications.

C. In the event of a conflict or discrepancy between these specifications and other documents project related such as but not limited to drawing files the contractor shall submit proper paper work to resolve the issue. Neither the specifications or the drawing files (or other documents) prevail unless you have clarifications in writing for the project your working on from UCB ITS.

D. The contractor shall review related project documents and report any and all concerns prior to installation.

1.03 COMMUNICATIONS SYSTEMS

A. The communications shall have the following systems:

1. Communications Cabling and Hardware: T-Series
   i. Cover with Legends.
   ii. Site Plan with Outside Plant.
   iii. Riser Diagrams with Conduit, Grounding, Voice, Utility, Qwest, Multi-mode Fiber, Single-mode Fiber and CATV.
   iv. Floor Maps with all Outlet locations.
   v. MDF Details with Footprint, Relay Rack Layout and Wall Design.
   vi. All additional TR Details with Footprint, Relay Rack Layout and Wall Design.
   viii. Remote MDF/ER/TR Details involved in the project.
   ix. Details sheet with Faceplates, Wireless Plates (Surface Box), Wireless Boxes, Camera Box, Floor Box, Stiff Leg Racks, Box Assembly, etc.
   x. Manholes, Hand holes, etc.
   xi. Outside Plant Prints.

2. Communications Demolition: TD-Series
3. Audiovisual: T-Series
4. Electrical Infrastructure: ET-Series

1.04 DIVISION 27 OVERVIEW

A. 27 00 00 COMMUNICATIONS
B. 27 01 00 OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS
C. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
D. 27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS
E. 27 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS
F. 27 08 00 COMMISSIONING OF COMMUNICATIONS
G. 27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS
H. 27 13 00 COMMUNICATIONS BACKBONE CABLING
I. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
J. 27 18 00 TESTING, IDENTIFICATION AND ADMINISTRATION
K. 27 20 00 DATA COMMUNICATIONS
L. 27 40 00 AUDIO-VIDEO COMMUNICATIONS
M. 27 50 00 DISTRIBUTED COMMUNICATIONS AND MONITORING SYSTEMS (CCURE, PAGING, ETC)

1.05 BIDDING REQUIREMENTS

A. Refer to 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS for the minimum qualifications for the Communications Contractor.
   1. Proof of Hubbell certification of the Communication Contractor is required to be provided with project bid.

B. Refer to 27 05 00 for firestop requirements and refer to the Architectural drawings for ratings of existing and new walls, floors, and other surfaces in the project area.
   1. The base bid for communications cabling project is required to include all firestop materials and installation for all existing and new communication cabling in the project area.

PART 2 - MATERIALS

2.01 THIS SECTION NOT USED.

PART 3 - EXECUTION

3.01 THIS SECTION NOT USED.
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section.

1.02 CONTRACT ADMINISTRATION

A. The Contractor shall carefully study and compare the Contract Documents and shall at once report to UCB and/or the Consultant/Engineer any error, inconsistency or omission identified. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable cost for correction.

B. The Contractor shall advise UCB as early as possible of any product delays and minimum quantity requirements that may affect the project timeline.

C. Should conflicts, discrepancies, deficiencies, or errors arise which require changes in the Contract Documents, immediately notify UCB PM’s and the Consultant/Engineer. Failure to do so shall be interpreted as the intention of the Contractor to supply all necessary labor and materials for the suitable completion of this work. Obtain written approval on necessary adjustments before the installation is started.

D. In the event that the consultant/Engineer is required to provide additional engineering services as a direct result of Contractor’s errors, omissions or failure to conform to the requirements of the Contract Documents, then the Engineer’s expenses in connection with such additional services shall be paid by the contractor and may be deducted from any monies owed the Contractor.

E. In the event that the Consultant/Engineer is required to provide additional engineering services as a result of substitution of equivalent materials or equipment by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer’s expenses in connection with such additional services shall be paid by the Contractor and may be deducted from any monies owed the Contractor.

1.03 PROJECT MANAGEMENT AND QUALITY ASSURANCE

A. The Contractor shall designate and identify a Project Manager to oversee the project work specified in this Division and to attend all project meetings as a representative of the Contractor. The Contractor’s Project Manager shall have the authority to act for the Contractor, and all communications given to the Project Manager will be deemed to have been given to the Contractor.

B. Contractor shall not begin construction on any project without written notice to proceed.

C. All additional costs must be approved in writing with a change order signed by UCB project manager or UCB ITS management.

D. Perform project management and coordinate all phases of the project with UCB staff.
1. Attend weekly project management meetings on site at the Telecommunications (Information Technology Services) Building on the UCB campus.

2. Provide and maintain a complete project schedule and timeline for all project activities including installation, inspection, and testing for each work activity in each building. The project schedule will be provided by the Contractor's Project Manager at the first project meeting within one week of contact award. The project schedule and timeline shall be updated as appropriate and will be provided and reviewed at each weekly project meeting thereafter.

E. Job supervision
   1. Designate and identify job supervisor in advance.
   2. Provide no more than one supervisor per job.
   3. Provide one primary contact, one backup contact.
   4. Inform UCB if contact is unavailable.
   5. Remove employees with behavior unacceptable to UCB.

F. Maintain the following information on the job site
   1. CU ITS Standards specifications (Division 27).
   2. All project related drawings.
   3. All addenda’s.
   5. All Change Orders.
   6. The Field Observation and inspection reports.
   7. Test results.
   8. Schedule and outage logs.
   9. As-built drawings set showing all changes.

G. Assist UCB in performing periodic inspections for evaluation and functional testing of communications subsystems or sections, as completed. Assist UCB in performing evaluation and functional testing of complete communications system(s).

H. Conduct an overall quality assurance program.

I. Apply and install materials, equipment, and specialties in accordance with manufacturer’s written instructions. Conflicts between the manufacturer’s instructions and the specifications shall be referred in writing to UCB for resolution.

J. All products, components, devices, equipment and materials shall be new and unused, clean, free from defects, and free from damage and corrosion.

K. Installation and service shall be performed by manufacturer trained and authorized personnel.

1.04 SUBMITTALS
A. The Contractor shall submit for review and approval a complete list of all materials, components, equipment, systems, and products proposed. Any requests for substitutions must be submitted with complete product data.

B. Product Data

1. Product submittals shall show, as a minimum, the following:
   i. Manufacturer, color, complete model and part number.
   ii. Dimensions.
   iii. Complete technical specifications and performance data.
   iv. Any other pertinent information necessary to determine adequacy for the intended application.

2. Product submittals are not required for manufacturer’s products listed as “approved” in this specification unless specifically required in individual sections of this Division. However, listed manufacturers products are held to all conditions of this specification. Contractor may be required to provide submittals for clarification of a specific item of equivalency prior to installation.

C. Substitutions

1. Requests to substitute for previously approved materials or equipment shall be submitted by the Contractor to UCB and the Engineer for review. Substitution requests shall include all required submittals and shall be complete with reasons for substitutions and savings which will accrue to UCB if substitutes are approved. Substitutes will be considered only if equal or superior to that specified.

2. Approval of alternate or substitute equipment or material in no way voids the Contract Document requirements.

3. Under no circumstances shall UCB be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner all evidence to support the contention that the item proposed for substitution is equal to the specified item. The UCB decision as to the equality of substitution shall be final and without further recourse.

4. The Contractor shall be liable for Engineer’s costs for review and for incorporation of accepted substitutions if the proposed substitutions require design modifications. The Engineer will bill the Contractor standard hourly rates for the time used to review substitutions and to incorporate proposed substitutions into design documents.

5. It shall be the responsibility of the Contractor to assure that the substitute material and/or equipment fits into the space provided and the Contractor shall pay for all extra costs incurred by other trades for any and all changes necessitated by these substitutions.

D. Statement of Warranty

1. The Contractor shall provide statement(s) of warranty based on the vendors’, manufacturers’ and Contractor’s warranties.

E. The Consultant shall submit the proposed outlet numbers, using the T-5 template provided by ITS, for review and approval prior to construction. The T-5 shall be submitted in two phases ad the CD level, one as a “Draft” T-5 at which time UCB ITS will return corrections to be made and within one week the “Final” shall be submitted with all the corrections made to the T-5 by the
Consultant to UCB ITS (some projects have the Contractors building and submitting the T-5 because of older specifications).

F. As-Built Drawings

1. All print changes shall be hand written by the contractor and signed off by the engineer and submitted to the CU ITS engineering or project Design Consultant for final AutoCAD prints to be submitted to CU ITS directly (this will be in addition to any submittals to the Architect).

2. At the beginning of work, the Contractor shall set aside one complete set of the project drawings which shall be maintained as a complete "as-built" set. The Contractor shall record all changes and deviations on the as-built drawing set. Changes that must be noted on the as-built drawing set shall include equipment numbering and labeling and any change in cabling or materials, cable routing, equipment placement, etc. In addition, installed cable footages for all backbone cabling shall be recorded on the as-built drawings.

3. Preliminary as-built station cabling drawings, with all outlet numbers identified on the floor-plans and a pre-numbered T-5 jack numbering template, shall be provided to UCB ITS at CD phase on big projects (within two days on small projects, by the Contractor instead of the Consultant for all submittals) and are expected to not change or adjust after the submittal unless errors are found which are corrected immediately after approval from UCB ITS. Additional T-5 lists shall be submitted for all deletions and additional outlets by the Consultant with an updated floor-plan. The submittal shall also include the contractor's construction timeline with all milestones included.

4. At one (1) week prior to occupancy, or as agreed on per the project schedule with UCB ITS, the contractor shall submit an updated hard copy of the as-built drawings and an updated electronic and hard copy of the T-5 jack numbering template of which the installed work was based with all the changes and device locations. All changes must have the approved signature of the UCB ITS project manager. Notations and changes shall be done in a neat and legible manner by marking the original drawings with red pencil to indicate additions and green pencil to indicate deletions. Within four (4) weeks of the testing the "As-built" T-5 shall be submitted (electronic) to UCB ITS and the Consultants by the Contractor with all testing corrections.

5. Contractor shall comply with attached document: Construction Drawings AS-BUILT Requirements.

6. A hard copy and electronic copy of the as-built files shall be submitted to UCB ITS from the contractor and communication consultant within four (4) weeks of completion of the project. All re-submittals shall be submitted within two (2) weeks to UCB ITS. These as-built documents apply to all projects unless written approval from UCB ITS. This submittal shall not be held up for delivery to UCB ITS for any reason. The Consultant has the final responsibility to get As-built files to UCB ITS within five (5) weeks of completion of the project. The Consultant has the final responsibility to get As-built files to UCB ITS within five (5) weeks of completion of the project.

G. Test Results and Configuration Information

1. Upon completion of the work, but before final approval, the Contractor shall submit test results and configuration information as required by each of the individual specification sections.

2. Standard UCB test sheets will be provided by UCB ITS for fiber optic cabling.
3. Test sheets for communication jacks will not be supplied to the Contractor by UCB ITS. The Contractor shall comply with the most current Hubbell Mission Critical Warranty documentation and procedure. All documentation including, but not limited to the “Structured Cabling System Registration Request Form,” “testing disk,” “Horizontal Schematic,” and “Backbone Schematic” shall be completed in full and shall include the installer’s full name, company name, telephone number, date completed, and UCB jack outlet with faceplate port numbers (e.g., 202-1D-1C5e-1D-3). All documentation shall be provided to both Hubbell and the University of Colorado ITS for warranty. The testing disk to UCB ITS shall be converted to a text format. Most projects will require as-built submittals of this information no later than 4 weeks following project completion and large projects may be subject to submittal on a monthly basis as determined by UCB ITS. Daily contractors will e-mail completions on a weekly basis.

4. Pursuant to required warranty validation documentation and procedures for cabling to support specialized technology systems, Contractor shall provide such documentation as required to the system manufacturer, with a copy to appropriate UCB representatives.

H. Design Consultant submittal

1. The final 100% CD comments shall be made to the design prints within one week and the final 100% CD prints shall be submitted to UCB ITS department.

1.05 PERMITS, LICENSES, INSPECTIONS AND FEES

A. The Contractor shall obtain all required permits, licenses and inspections and shall pay all legal and proper fees and charges including taxes, royalties, and other related charges. No work shall be started before obtaining all necessary permits and paying all required fees.

B. The Contractor shall, at inception of the work, provide UCB with copies of all required building and trade permits, if said are required.

C. The Contractor shall furnish and file with the proper authorities all drawings required by them in connection with this work.

D. The Contractor shall be responsible for arranging all inspections and for securing all required signatures. Upon completion of the work, properly completed permits shall be returned to UCB, if any are required.

1.06 PERIODIC FIELD OBSERVATION REPORTS

A. UCB will conduct site visits as required to monitor the progress and quality of the workmanship and the work environment as well as the surrounding facility. Any item found by UCB to be deficient will be documented in a Periodic Field Observation Report.

B. The Contractor shall take appropriate action to immediately correct and rectify any items deemed unsatisfactory by UCB. The Contractor shall not wait for a hard copy of the Periodic Field Observation Report if the action required to rectify the situation is obvious and clear.

C. Contractor shall post and shall comply with attached document: CONSTRUCTION INSPECTION REPORT – VOICE AND DATA COMMUNICATIONS for all aspects of this project.

1.07 INSPECTIONS AND TESTS

A. The Contractor shall furnish promptly, without additional charge, all test equipment, instruments, facilities, labor, and material needed to perform safe and convenient inspection and testing.
B. Prior to beginning work, the Contractor shall submit to UCB a complete project schedule and timeline including installation, inspection, and testing for each project area so that interim inspections can be conducted as work progresses. UCB shall not be obligated to inform the Contractor of its intent to inspect job sites while work is in progress.

C. The Contractor shall perform pre-testing of the installed telecommunications systems to determine compliance and notify UCB ITS personnel when the system is ready for final inspection and testing. UCB shall be present for final inspection and testing within five business days of such notification by the Contractor.

D. At such time as UCB and/or the Consultant/Engineer may direct, and in the presence of the UCB ITS representative and/or Consultant/Engineer, conduct final inspection and testing of all telecommunications systems, both new and existing where modified.

E. Except as otherwise provided in the specifications, inspection and testing of materials and workmanship shall be made at reasonable times and at the site of the work. UCB may determine that inspection or testing of materials shall be made off-site, at the place of production, manufacture, or shipment of the material. Such off-site inspection or testing shall not relieve the Contractor of responsibility for damage to or loss of the material prior to acceptance, nor in any way affect the continuing rights of UCB after acceptance of the completed work.

F. Work shall not be covered up or enclosed until inspected by UCB personnel or other proper authorities. Should any work be covered up or enclosed before such inspection, it shall be uncovered, inspected, and after approval, restored by the Contractor to finished condition at no additional cost to UCB.

G. All work that is determined to be unsatisfactory shall be corrected immediately. The Contractor shall, without charge, replace any material or correct any workmanship found by UCB not to conform to the specifications, unless UCB consents to accept such material or workmanship with appropriate adjustment in price. The Contractor shall promptly segregate and remove rejected material from the premises. The Contractor will pay the additional cost of any test or inspection of the replaced material or corrected workmanship.

H. The Contractor shall prepare a written report of final test results together with UCB standard test sheets and all additional pertinent information and submit these to UCB ITS and/or the Consultant/Engineer for acceptance.

I. The telecommunications rooms and other rooms employing communications technology systems identified as part of the work scope for this project shall be labeled and laid out well in advance of testing, including the outlet numbers on the patch panels (as soon as the racks are mounted) to allow pre-inspections and at least three (3) weeks prior to testing for large projects.

1.08 CONTINUITY OF SERVICES AND SCHEDULING

A. The buildings may be in use during construction operations. Insofar as possible, the Contractor shall employ such methods or means as will not cause interruption of, or interference with, the owner’s scheduled use of the building and will maintain existing systems in operation within all rooms of the building at all times.

B. For areas under renovation, coordinate all installation activities with UCB and other trades for renovations of architectural, mechanical, and/or electrical facilities. Insofar as possible, the Contractor shall employ such methods or means as will not cause interruption of, or interference with, the work of any other contractor.

C. Moving or removing any facility must be done so as not to cause interruption of the project work or of University operation.
D. Disruption of critical services will require after hour or weekend working constraints.

E. Existing communication services shall be interrupted only with consent from UCB. An advance warning time of seven working days shall be given. Such interruptions shall be preceded by all possible preparations which will minimize down time to expedite that particular phase of the work pursuant to good workmanship. This shall be done at regular and premium time as approved by UCB without additional expense to UCB.

F. Adjust work schedule within reason (weekly), as per direction of UCB, and coordinate with work or other trades in order to make portions of project available to UCB as soon as possible.

G. All expenses due to untimely or improperly coordinated work shall be the responsibility of the Contractor.

1.09 USE OF CABLE PRIOR TO ACCEPTANCE

A. The Contractor shall permit the placement and installation by UCB of cross-connects, patch cords, and/or equipment onto cable and terminations installed under this contract, prior to substantial completion of the contract as necessary. Such placement or installation shall not evidence completion of the work or portion thereof, nor signify UCB acceptance of the work or portion thereof.

B. Cabling and equipment provided under this contract, whether the work of the Contractor is partially or fully completed or not, shall be the property of UCB. UCB shall have certain rights and privileges in connection with use of same.

1.10 FINAL ACCEPTANCE AND WORK CLOSEOUT

A. Contractor shall inspect the entire telecommunications system installation to assure all work is completed and all systems are completely operational before calling for final inspection, testing and acceptance of work.

B. Punch-List Close-out:
   1. Notify UCB when telecommunications work is ready for final inspection and punch list preparation.
   2. Resolve all punch list items before final invoicing.
   3. Turn in all as-built prints to UCB ITS, the Architect and keep a copy for your file.
   4. Final payment will not be authorized until all punch list items have been resolved and completed to the satisfaction of UCB with as-built files turned in.

C. After the successful installation inspections and functional testing by UCB and the Contractor, UCB will determine if there are any open issues or discrepancies and notify the Contractor. Upon completion or determined failure, UCB will issue written notification to the Contractor as to the status of the installation acceptance.

PART 2 - MATERIALS

2.01 THIS SECTION NOT USED.

PART 3 - EXECUTION

3.01 THIS SECTION NOT USED.
END OF SECTION 27 01 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section

1.02 SCOPE OF WORK

A. Work includes, but is not limited to, the following:

1. Placement of and additions to Telecommunications Room (TR) and Equipment Room (ER) hardware including equipment racks, cable routing hardware, copper and fiber termination equipment, patch cords, and grounding and bonding.

2. Placement of and additions to hardware for AV Educational Technology systems for classrooms and lecture halls, including technology cabinets, equipment racks, cable routing hardware, copper and fiber termination equipment, patch cords, and grounding and bonding.

3. Placement of and additions to interior telecommunications pathways including conduit, pull-boxes, and metallic surface-mount raceway systems.

4. Placement of and additions to exterior telecommunications pathways including trenching/backfill, conduit system, pull-boxes, handholes, manholes and cable routing hardware.

5. Installation and termination of backbone cabling including copper cabling, coaxial cabling, and singlemode and multimode fiber optic cabling.

6. Installation and termination of horizontal cabling including copper cabling, coaxial cabling, and multimode fiber optic cabling.

7. Testing, identification, and administration for the above telecommunications systems.

8. Removal of existing horizontal cabling, terminations, and outlets in coordination with electrical contractor for removal of associated conduit.

B. All work shall be conducted in coordination with UCB ITS and other building trades.

C. The work covered by this Division consists of furnishing all materials, accessories, connectors, supports, electrical protection, equipment, tools, setup, preparation, labor, supervision, incidentals, transportation, storage, and related items and appurtenances, and performing all operations necessary to complete the telecommunications work as indicated in the project drawings and specified herein. It is the intent and purpose of this specification to have, upon completion of the project, a “turn-key” telecommunications system designed, built, coordinated and integrated with the existing telecommunications system and complete and operable in all respects. Completely install, connect, and test all systems, equipment, devices, etc., shown or noted or required to final connections and leave ready for satisfactory operation. Provide any minor items omitted from the design, but obviously necessary to accomplish the above intent.

D. All telecommunications designs for UCB buildings on and off campus must be approved by the UCB ITS department for standard and design structure. Any design outside of these ITS standards must be approved and include a written agreement for the design from the UCB ITS department.
E. Minimum composition requirements and/or installation methods for the following materials and work are included in this section:

1. Cables
2. Factory Assembled Products
3. Compatibility of Related Equipment
4. Special Tools and Kits
5. Firestops and Penetration Seals
6. Anchoring and Supports
7. Grounding and Bonding
8. Cutting and Patching
9. Concealment
10. Equipment Modification

1.03 GLOSSARY

A. ANSI American National Standards Institute
B. ASTM American Society of Testing and Materials
C. BICSIB Building Industry Consulting Services International
D. FCC Federal Communications Commission
E. IEEE Institute of Electrical and Electronics Engineers
F. ISO International Organization for Standardization
G. ITS Information Technology Services
H. NEC National Electrical Code
I. NEMA National Electrical Manufacturer’s Association
J. NESC National Electrical Safety Code
K. NFPA National Fire Protection Association
L. OSHA Occupational Safety and Health Administration
M. TIA Telecommunications Industry Association
N. UCB University of Colorado at Boulder
O. UFBC Uniform Fire Prevention and Building Code
P. UL Underwriter’s Laboratories, Inc.
A. References to regulations, codes, and standards mean the latest edition, amendment and revisions to the regulations, codes and standards in effect on the date of the Contract Documents.

B. All work and materials shall conform to and be installed, inspected, and tested in accordance with the governing rules and regulations of federal, state, and local government agencies.

C. Installations, materials, equipment and workmanship shall conform to the specifications and drawings and all applicable provisions of the following regulations, codes, and standards including all applicable addenda:

1. ANSI/NEC (NFPA 70)
2. NESC (IEEE)
4. ASTM Standards
5. IEEE Standards
6. NEMA Standards
7. ANSI/TIA – Telecommunications Cabling Standards including, but not limited to, 568-C.0, 568-C.1, 568-B.2, 568-C.3, 569-B, 598-C, 455 Series, 492 Series, 526 Series, 604 Series, 606, 607, 758-A, TSB-140, FIP 174, FIP 175, FIP 176, S-83-596, S-87-640
8. FCC Code of Federal Regulations (CFR)
9. Applicable State of Colorado codes including UFBC and Department of Labor Rules and Regulations
10. Applicable Municipal codes
11. Applicable codes and regulations of other authorities having lawful jurisdiction pertaining to the work required
12. Americans with Disabilities Act (ADA)
13. UCB Standards

D. All modifications required by the referenced codes, rules, regulations, and authorities shall be made by the Contractor without additional charge to UCB.

E. Report immediately to UCB ITS personnel and/or the Consultant/Engineer, in writing, any part of the telecommunication system design which does not conform to the requirements of these codes or regulations, or otherwise be held responsible to provide and install material which will comply with these codes and regulations.

F. Applicable codes and ordinances and local interpretations take precedence when they conflict with or are more stringent than the telecommunications design. Drawings and specifications take precedence where this design is more stringent than codes and ordinances.
G. All materials, appliances, equipment, and devices shall conform to the applicable standards of Underwriters Laboratories (UL), and shall be listed by UL if a UL listing category has been established. Furnish products that have been tested and qualified to meet the rating criteria by UL or other testing firm acceptable to authority having jurisdiction.

1.05 SAFETY AND HEALTH REQUIREMENT

A. These construction documents and all phases of construction completed are to be governed by applicable provisions of the “Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 91-596” and the latest amendments including:

1. Reporting/Investigating Accidents
2. Enforcement of Program
3. Telecommunications 1910.268
5. Confined Space 1910.146
6. Lockout/Tagout 1910.147
7. Asbestos 1910.1001
8. Assured Grounding 1926.404
9. Portable Wood Ladders 1910.25
10. Portable Metal Ladders 1910.26
11. Electrical Protection 1910.268
12. Exposure and Medical Records 1910.20
13. Emergency Evacuation 1910.38
14. Hantavirus/General Duty Clause/CDC Guidelines

B. Comply with specific UCB safety requirements.

C. Receive training if working in hazardous areas.

D. Provide hazards training certificates.

E. Inspect work sites for hazards regularly.

F. Provide safety program documents.

G. Comply with National Electrical Safety Code NESC C2-1997 including, but not limited to:

1. Section 42, General Rules for Employees.
2. Section 43, Additional Rules for Communications Employees.

H. The contractor shall be aware of and comply with UCB regulations for confined spaces (contact EH&S 303-492-0215).

1.06 ASBESTOS/LEAD
A. The University manages asbestos/lead identification, removal and control. Normally the site of work operations will be identified by the University as suitable for construction to proceed and EH&S documentation is provided for the Contractor file. The Contractor shall refer to and comply with the EH&S report from UCB prior to performing any work. If that documentation is not available, the Contractor will not proceed with the work.

B. The Contractor shall be aware of and comply with UCB specific procedures and policies related to asbestos and lead (contact EH&S 303-492-0215).

C. The University requires appropriate asbestos awareness training for Contractor employees. This shall be provided to Contractor employees at the expense of the Contractor and at no cost to the University.

D. In the event the Contractor encounters suspected asbestos/lead containing materials which have not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to UCB verbally and followed by written notice. If in fact the material contains asbestos/lead and has not been rendered harmless, the project work in the affected area shall not thereafter be resumed except by written agreement of UCB and the Contractor. In the absence of asbestos/lead, or when it has been rendered harmless, project work shall be resumed by written agreement of UCB and the Contractor.

1.07 DEFINITIONS

A. Every effort has been made to use industry standard terminology throughout this specification, but industry standard terminology is not used by all manufacturers and, in many cases, industry standard terminology does not exist. Contractor shall notify the UCB ITS Personnel and/or the Consultant/Engineer to define terminology used in specifications if they believe any questions could arise.

B. Approved/ApprovalWritten permission to use a material or system

C. ContractorTelecommunications Contractor performing work under Division 27

D. EngineerTelecommunications engineer for Division 27

E. Equal/EquivalentEqually acceptable as determined by UCB or Engineer

F. Final AcceptanceUCB acceptance of the project from Contractor

G. FurnishSupply and deliver to installation location

H. InspectionVisual observation at job site by UCB representative

I. InstallMount and connect equipment and associated materials ready for use

J. JackModular connector for station cabling medium (UTP copper, fiber, coax) at work-area outlet.

K. OutletBox and faceplate to accommodate up to six (6) modular jacks at the work-area.

L. Pull-BoxBox to be used for pull-through of cabling in a conduit run. Not to be used as a junction box.

M. ProvideFurnish and install complete with all details and ready for use

N. RelocateDisassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use
O. ReplaceRemove and provide new item

P. Telecommunications All work specified in Division 27

Q. Where this Division 27 indicates work to be performed by the words "shall" or "secure" or other performance functions, it shall be assumed that such work shall be performed by the telecommunications Contractor performing work under Division 27.

1.08 DRAWINGS AND SPECIFICATIONS

A. It is the intention of these specifications and related project drawings to call for finished work, tested and ready for operation in complete accordance with all applicable codes, regulations, standards, and ordinances.

B. These specifications and the project drawings are complimentary, and what is called for in either of these shall be binding as though called for by both. Should any conflict arise between the drawings and specifications, such conflict shall be brought to the attention of the Engineer for resolution. If the Contractor fails to contact the Engineer in writing of any conflict between the specifications and the project drawings, the Contractor shall be subject to re-work the area of conflict at the Contractor’s cost.

C. Omissions from the specifications and/or project drawings or the incorrect description of details of work which are evidently necessary to carry out the intent of the specifications and project drawings, or which are customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described detail of the work. All work shall be performed as verified in field measurements, field construction criteria, material catalog numbers and similar data checked and coordinated with each shop drawing by the Contractor.

D. The telecommunications and technology project drawings are diagrammatic and indicate general design, layout, and arrangement of equipment and various systems. Being diagrammatic, the drawings may not necessarily show all details such as pull-boxes, conduit runs or sizes, etc., necessary for a complete and operable system. Unless detailed dimensioned drawings are included, exact locations are subject to approval of UCB.

E. Do not scale project drawings for dimensions. Take all dimensions and measurements from the site and actual equipment to be furnished. All dimensions, measurements, and the location and existence of underground equipment must be verified in the field since actual locations, distance, and elevations will be governed by actual field conditions. Contractor shall be responsible for all measurements taken from the field.

1.09 EXAMINATION OF PROJECT SITE

A. Prior to any project work, examine the project site carefully, including all project drawings showing existing systems and equipment. The Contractor shall be fully informed of and shall identify all utility, state, and local requirements that will affect the telecommunications work at the project site.

B. It shall be the Contractor’s responsibility to determine if the installation of the proposed systems will affect the operation or code compliance of existing systems. With UCB approval, relocate, modify, or otherwise revise existing telecommunications systems as required to maintain operational integrity and code compliance.

C. The Contractor shall become familiar with the local conditions under which the work is to be performed and correlate the on-site observations with the requirements of the specifications and project drawings. No allowance will be made for claims of concealed conditions which the Contractor, in exercise or reasonable diligence in examination of the site, observed or should have observed.
D. Before ordering any materials or doing any project work, verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of unverified differences between actual dimensions and the measurements indicated on the project drawings. Any discrepancies found shall be submitted in writing to the Engineer for consideration before proceeding with the project work.

1.10 WORKMANSHIP, WARRANTY, AND SUPPORT

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for one full year from final acceptance for each project. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed as free from defects, transpositions, opens/shorts, tight kinks, damaged jacket insulation, etc.

B. Furnish a written warranty to UCB for a minimum of:

1. One-year materials warranty on parts and labor to repair/replace defective telecommunications materials specified herein. This warranty only applies to materials provided by Contractor and does not apply to materials provided by UCB.

2. Twenty-five-year Hubbell and Mohawk materials warranty on parts and labor to repair/replace defective telecommunications station cabling materials. The installer/contractor shall be certified by Hubbell to provide the materials warranty.

3. One-year installation workmanship warranty on parts and labor to resolve problems related to telecommunications system installation workmanship.

C. The Contractor shall be responsible for and make good, without expense to UCB, any and all defects arising during this warranty period that are due to imperfect materials, appliances, improper installation, or poor workmanship.

1. During the warranty period, provide all labor required to repair or replace defects in the telecommunications system, at no cost to UCB.

2. During the warranty period, provide new materials to repair or replace defects in the telecommunications system, at no cost to UCB.

PART 2 - MATERIALS

2.01 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. All materials and equipment shall be new, free from defects, installed in accordance with manufacturer’s current published recommendations in a neat manner and in accordance with standard practices of the industry.

B. Where no specific material, apparatus, or appliance is mentioned, any standard, first-class product made by reputable manufacturer regularly engaged in the production of such material may be used providing it conforms to the contract requirements and meets the approval of UCB ITS Personnel and/or the Consultant/Engineer.

C. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

D. Materials shall meet or exceed the following minimum requirements:
1. Where applicable, all materials and equipment shall bear the label and listing of UL. Application and installation of all listed equipment and materials shall be in accordance with such labeling and listing.

2. Equipment shall meet all applicable FCC regulations.

3. Electrical equipment and systems shall meet UL standards and requirements of the NEC. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

4. The listing of a manufacturer as “acceptable” does not include acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the specifications and meet the quality of the specified item.

5. Materials and equipment shall bear the manufacturer’s name or trademark and model/serial number permanently marked.

2.02 CABLES

A. All telecommunications cabling inside the building shall be UL listed and marked type CM, CMR, CMP, CATV, CATVR or CATVP and shall be installed in accordance with NEC articles 300-22, 800-49, 800-50, 800-51, 800-52, 800-53, and 820. The substitutions listed in articles 800.154 and 820.154 shall be permitted.

B. All fiber optic cable inside the building shall be UL listed and marked type OFN, OFNR, or OFNP and shall be installed in accordance with NEC articles 300-22, 770-49, 770-50, 770-51, 770-52, and 770-53.

2.03 FACTORY ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.

2. Constituent parts, which are alike, shall be the product of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for intended service.

4. Contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver the specified performance of the complete assembly.

2.04 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

2.05 SPECIAL TOOLS AND KITS

A. The Contractor shall furnish any special installation equipment, tools, or kits necessary to properly complete the telecommunications system installation. This may include, but is not limited to, tools for pulling, splicing, terminating, and testing the cables, communication devices, stands for cable reels, cable wenches, assembly and adjustment devices, etc.
2.06 FIRESTOPS AND PENETRATION SEAL MATERIALS

A. Use qualified systems to firestop through penetrations in fire-rated walls and floors for pipes, cables, conduits, ducts, inner-ducts, and cable trays.

B. Firestopping for openings through fire and smoke-rated walls and floor assemblies shall be listed or classified by an approved independent testing laboratory for “Through-Penetration Firestop Systems.” The system shall meet the requirements of “Fire Tests of Through-Penetration Firestops” designated by ASTM E814.

C. Inside all conduits, the firestop system shall consist of a dielectric, water-resistant, non-hardening, permanently pliable/re-enterable putty along with appropriate damming or backer materials (where required). The sealant must be capable of being removed and reinstalled and must adhere to all penetrants and common construction materials and shall be capable of allowing normal cable movement without being displaced.

D. Foam sealant shall meet all fire test and hose stream test requirements of ASTM E-119-73 and shall be UL classified as a wall opening protective device.

E. Provide devices/systems fire tested by a third party according to ASTM E 814 (or UL 1479) tested under positive pressure.

F. Provide specific combinations of materials installed and supported or anchored.

G. Provide only material combinations that are qualified by independent agencies based on the material’s performance when tested in a particular configuration.

H. Match the thickness (and/or depth) of firestop materials to that recommended by the manufacturer.

I. Thickness of materials must be established by formal ASTM E814 or UL 1479 tests.

J. Firestop for fire-rated floors and walls:
   1. 3M Fire Protection
   2. Specified Technologies, Inc. (STI)

2.07 ANCHORING MATERIALS AND SUPPORTS

A. Metal bars, plates, channel, tubing, etc. shall conform to ASTM Standards:
   1. Steel plates, shapes, bars, and grating – ASTM A36
   2. Cold-formed steel tubing – ASTM A500
   3. Hot-rolled steel tubing – ASTM A501
   4. Steel pipe – ASTM A53, Schedule 40, welded

B. Metal fasteners shall be zinc-coated.

C. Anchoring Materials:
   1. Structural Steel
   2. Steel Channel: Galvanized or painted
3. Uni-Strut

2.08 GROUNDING AND BONDING MATERIALS
   
   A. Mechanical Connectors: Bronze.
   
   B. Bonding Conductor: 6 AWG minimum copper
   
   C. All grounding equipment shall be UL listed for that purpose.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS
   
   A. The approximate locations of existing and new telecommunications outlets, cabling and equipment will be indicated on the project drawings; however, the drawings are not intended to give complete and accurate information. Contractor is responsible to field verify existing outlets and cabling prior to submitting quote. Determine the exact location after thoroughly examining the general building plans and by actual measurements before and during construction, subject to the approval of UCB and/or the Consultant/Engineer.
   
   B. Before construction work commences, visit the site and identify the exact routing for all horizontal pathways and equipment placement. Verify all dimensions, locating the work and its relation to existing work, all existing conditions and their relation to the work and all man made obstructions and conditions, etc. affecting the completion and proper execution of the work as indicated in the project drawings and specifications.
   
   C. If core drills are required, the exact core locations shall be identified and coordinated with the UCB Asbestos Management plan as necessary.
   
   D. All equipment locations shall be coordinated with UCB, other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.
   
   E. Coordinate work with UCB, other trades and existing conditions to determine exact routing of cable, cable tray, hangers, conduit, etc., before fabrication and installation.
   
   F. Install telecommunications cabling and equipment to facilitate maintenance and repair or replacement of equipment components. Provide easy, safe and code mandated clearances at equipment racks and enclosures, and other equipment requiring maintenance and operation. Coordinate with UCB exact location and mounting height of all equipment in finished areas, such as equipment racks, termination equipment, communication and electrical devices. As much as practical, connect equipment for ease of disconnecting, with a minimum of interference with other installations.
   
   G. Coordinate ordering and installation of all materials and equipment with long lead times or having major impact on work by other trades so as not to delay the job or impact the schedule.
   
   H. Set all equipment to accurate line and grade, level all equipment and align all equipment components. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.
   
   I. Provide all scaffolding, rigging, hoisting and services necessary for delivery, installation, and erection of materials, equipment, and apparatus furnished into the premises. These items shall be removed from premises when no longer required. Use of University owned supplies and equipment is prohibited.

3.02 WORKMANSHIP
A. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.

B. Good workmanship and appearance shall be considered of equal importance with telecommunications operation. Lack of quality workmanship shall be considered sufficient reason for rejection of a system in part or in its entirety. Carefully lay out all work in advance and install in a neat and workmanlike manner in accordance with recognized good practices and standards. Provide workmen who are skilled in their craft and a competent Project Manager who will be on the job at all times.

3.03 CABLES

A. Backbone and horizontal telecommunications cabling shall be placed in separate dedicated pathways. Cable trays shall be clearly divided between backbone and horizontal cabling.

B. Telecommunications pathways shall be dedicated for use for ITS voice, data & CATV cabling only. No other cabling type of cabling (intercom, audio, video, security, fire, etc.) may be placed in telecommunications pathways without prior written approval from UCB ITS.

C. All horizontal cabling terminating within a single faceplate must be routed to and terminated in the same ER or TR.

D. Consolidation points and multi-user telecommunications outlet assembly (MUTOA) configurations for horizontal cabling are not currently supported by UCB ITS and will not be permitted.

3.04 CUTTING AND PATCHING

A. Provide all cutting, patching and core drilling, etc., as necessary for telecommunications work. Locate holes and outlets to be drilled and coordinate with work of other trades. Obtain approval of UCB prior to cutting or core drilling holes greater than ¾” in structural members.

B. Cut and drill from both sides of walls and/or floors to eliminate splaying.

C. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering and other finished surfaces. Patch openings and damaged areas equal to existing surface finish.

D. Cut openings in prefabricated construction units in accordance with manufacturer’s instructions.

E. Openings for electrical work shall be carefully caulked or grouted as required. Spare conduits shall be tightly capped.

F. All cutting in the building construction made necessary to admit work, repair defective materials, defective workmanship, or by neglect of the Contractor to properly anticipate his requirements, shall be done in accordance with these specifications with no additional cost to UCB. Patching shall be complete in every detail. Actual work involved in these repairs shall be done by skilled craftsmen in the trades involved.

G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.05 CONCEALMENT

A. Use existing conduit and cable trays where possible and practicable. Conceal all project work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is
impossible or impracticable, notify UCB and/or the Consultant/Engineer before starting that part of the work and install only after approval.

3.06 EQUIPMENT MODIFICATION

A. Where existing equipment is to be modified, Contractor shall furnish materials and labor as necessary to modify or add to the equipment. Modifications shall be done neatly with factory parts and assemblies approved for the application. Modification shall in no way jeopardize the compliance of existing equipment with any governing codes and regulations.

3.07 FIRESTOPs AND PENETRATION SEALS

A. All new and existing penetrations through fire-rated walls, floors, ceilings, etc. shall be sealed to prevent the spread of smoke, fire, toxic gas, or water through the penetration either before, during, or after a fire. The fire rating of penetration seal shall be at least that of the wall, floor, or ceiling into which it is installed, so the original fire rating is maintained. The installation shall provide an air and watertight seal. This includes all existing telecommunications cables and pathways to remain within the project area.

B. All new and existing conduit and sleeve openings used for the project shall be waterproofed or fireproofed upon cable placement through such passageways in compliance with Colorado Building and Fire Codes and UCB standards.

C. Patch all openings remaining around and inside all new and existing conduit sleeves and cable penetrations to maintain the integrity of any fire-rated wall, floor, ceiling, etc.

D. Manufacturer’s installation standards shall be closely followed (minimum depth of material, use of ceramic fiber, procedures, etc.).

E. Brick, Concrete, and Concrete Blocks Walls:

1. Provide metallic sleeving systems for routing of cables through these surfaces.
2. Ensure that sleeve extends from the front and back of the wall only far enough to attach the required bushing or collar.
3. Secure sleeves in place according to manufacturer’s specifications.
4. Provide firestop seal between sleeve and wall, but do not use firestopping material to support or secure sleeve.
5. Firestop around any inner-duct used to contain fiber optic cable through a wall.
6. Firestop ends of sleeving or inner-duct after installation of cable, without exception.

F. Floor Openings:

1. Install firestop materials to stop openings between sleeving (or other supporting material) and core.
2. When coring through concrete flooring, use boots and packing materials to fashion core before installing firestopping materials.
3. If rectangular openings exist in concrete floors, use steel sleeving to fashion opening before installing firestopping materials.
4. Firestop around any inner-duct used to contain fiber optic cable through a floor.
5. Firestop openings in slots, sleeves or ducts after installation of cable, without exception.

G. Cable Trays: All new cable tray pathways shall not penetrate fire-rated walls. Cable tray shall stop within 6 inches of the wall and fire-rated wall shall include EZ path product or equivalent approved by ITS fire stopping system.

1. Close cable tray penetrations with a qualified firestopping system.
2. Install the system according to the manufacturer’s instructions.
3. Ensure that system provides proper support and relief of firestop materials.
4. Firestop materials must be easily removable if required.
5. Firestopping materials must provide for installation of cable through the opening without the replacement of material.
6. Use of intumescent sheets of approximately .5 inch maximum thickness is preferred.

H. Fire-Rated Gypsum Walls:

1. Sleeve all penetrations of gypsum walls used for cable routing if cable is not in conduit or inner-duct (fiber).
2. Firestop seal between sleeve, conduit, or inner-duct and wall on both sides of the wall.
3. Use qualified firestop systems to seal penetrations in gypsum wallboard assemblies.
4. Verify that penetration conditions fall within the following firestop system parameters:
   i. Hourly rating.
   ii. Opening size.
   iii. Annular space.
5. Install the firestop system symmetrically on both sides of the wall.
6. Install the materials according to manufacturer-tested methods.
7. Box out gypsum penetrations used for cable trays.
8. Firestop gypsum box with qualified system.
9. Use identical guidelines for penetrations of hollow lath or plaster surfaces.

I. Other Firestopping:

1. Firestop through penetrations according to the guidelines for the basic construction of the two outermost layers of the combination wall.
2. Firestop load-bearing stud walls that are part of combination walls by enclosing (i.e., boxing) the penetration in the cavity.
3. Firestop partial penetrations according to the recommendations for the type of wall being penetrated.
4. Firestop any penetrations which violate the fire-rating integrity of vertical shafts.
5. Firestop openings around outlet boxes installed in fire-rated walls, on both sides.
J. Firestop Installation Methods:
1. Use drop cloths to protect other surfaces when installing.
2. Firestop completely around each cable individually – do not stop bundles of cables.
3. If using putty around a vertical penetration, use putty to build flooring of seal, fill with fiber or rock wool to required thickness, then top with putty according to Manufacturer’s specifications.
4. The methods used shall incorporate qualities that permit the easy removal or addition of conduits or cables without drilling or use of special tools.
5. The product shall adhere to itself to allow repairs to be made with the same material and to permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling, and resulting reduction in fire rating.

K. The installed firestop system shall meet the requirements of “Fire Tests of Through-Penetration Firestops” designated ASTM E814.

L. Seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.

M. Spare conduits shall be plugged with expandable plugs.

N. All service entrance conduits through the building shall be sealed or resealed upon cable placement.

O. Entrance conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or waterproof duct seal.

P. The firestop system shall be submitted to UCB ITS at the preconstruction meeting with a list or map of each location and system number used for the project.

3.08 ANCHORING METHODS

A. Anchor and brace all cabling, material, and equipment installed under this Division as required by all codes, regulations, and standards. Provide required supports, beams, angles, hangers, rods, bases, braces, straps, struts, and other items to properly support project work. Supports shall meet the approval of UCB.

B. Supports shall be fabricated from structural steel, steel channel, or uni-strut, rigidly bolted or welded to present a neat appearance.

C. Fastenings and supports shall be adequate to support loads with ample safety factors.

D. Fasten hanger rods, conduit clamps, outlet boxes, and pull-boxes to building structure.

E. Use toggle bolts, spider type expansion anchors, or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls.

F. Use lead expansion shields or expansion anchors or preset inserts in solid masonry walls.

G. Use self-drilling anchors or lead expansion anchor on concrete surfaces.

H. Use sheet metal screws in sheet metal studs.
I. Use wood screws in wood construction.

J. In pre-cast structures, use cast-in inserts wherever possible. Expansion anchors can be used with caution, but only with prior approval.

K. In cast-in-place concrete, use expansion anchors, preset inserts, or self-drilling masonry anchors.

L. Use lead expansion anchors, or preset inserts on metal surfaces.

M. Do not fasten supports to piping, ceiling support wires, ductwork, mechanical equipment, or conduit.

N. Power-actuated anchors, plastic or fiber expansion anchors, and drive pin anchors are prohibited.

O. Do not drill structural steel members.

P. Any anchoring must be able to be unsecured and removed should relocation be required. The old Hilti HIT-pin is not acceptable.

Q. Where necessary and with approval from UCB, modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit project work. If necessary in stud walls provide special supports from floor to structure above.

R. For precast panels/planks and metal decks, support communication work as determined by manufacturer and UCB.

S. Provide heavy gauge steel mounting plates for mounting project work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.

T. Install freestanding telecommunications equipment on concrete pads.

U. Support surface mounted cabinets, enclosures, and panelboards with a minimum of four anchors.

V. On exterior concrete walls below grade, provide 1” steel channel stand-offs for cabinets and raceways.

W. Use stud bridges at top and bottom of cabinets and enclosures that are flush mounted on hollow drywall walls.

X. Use suitable vibration isolation pads for vibrating equipment.

3.09 GROUNDING AND BONDING

A. Bond all new metallic cable shields and metallic supporting structures, in all equipment rooms and service entrances, including racks, frames, protectors, and cabinets to the existing telecommunications grounding busbar (TGB), according to the manufacturer’s specifications.

B. Do not make connections between the telecommunications busbar system and building electrical grounds, or other types of connections, without UCB approval.

C. Bond metallic surfaces of telecommunications hardware with #6 AWG grounding wire as straight as possible to the ground source.

D. Ensure that the grounding system is physically secured.
E. All grounding conductors leaving the ER and TRs shall be in a separate conduit from all communication cabling.

F. All grounding items shall be installed in complete compliance with Division 16 and NEC.

APPENDIX FOR EQUIPMENT SCHEDULE:

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One EZ-Path System</td>
<td>STI</td>
<td>EZDP33FWS</td>
</tr>
<tr>
<td>2</td>
<td>Two EZ-Path System</td>
<td>STI</td>
<td>EZDP233GK</td>
</tr>
<tr>
<td>3</td>
<td>Three EZ-Path System</td>
<td>STI</td>
<td>EZDP333GK</td>
</tr>
<tr>
<td>4</td>
<td>Four EZ-Path System</td>
<td>STI</td>
<td>EZDP433GK</td>
</tr>
</tbody>
</table>

END OF SECTION 27 05 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section.

1.02 SCOPE OF WORK

A. Provide all services labor, materials, tools, and equipment required for the complete and proper installation of interior telecommunications pathways as called for in these specifications and related drawings.

B. This section includes minimum requirements and installation methods for the following:

1. EMT Conduit and Cable Tray Systems
2. Surface Metal Raceway Systems
3. Wireless Access Boxes
4. Educational Technology Cabinets for Classrooms and Lecture Halls

1.03 QUALITY ASSURANCE

A. All installation work for the new interior telecommunications pathways shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of UCB.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval of UCB based on submittals provided.

C. Materials and work specified herein shall comply with the applicable requirements of:

1. ANSI/NFPA 70 – National Electrical Code including, but not limited to, the following articles:
   i. 250 – Grounding
   ii. 300 – Wiring Methods
   iii. 314 – Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Manholes
   iv. 358 – Electrical Metallic Tubing: Type EMT
   v. 386 – Surface Metal Raceways
   vi. 392 – Cable Trays
   vii. 770 – Optical Fiber Cables and Raceways
2. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, including applicable addendum
5. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
6. ANSI/TIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications
7. BICSI Telecommunications Distribution Methods Manual

1.04 SUBMITTALS
A. As-built drawings

PART 2 - MATERIALS

2.01 EMT CONDUIT AND CABLE TRAY SYSTEMS
A. Electrical Metallic Tubing (EMT): Electro-galvanized steel tubing 3/4” and larger diameter per project requirements:
   1. Conduit joint couplings and connectors: steel double set screw indenter fittings
   2. Metal bushings for 3/4” and 1” conduit
   3. Insulated metallic bushings for 1-1/4” and larger conduit
   4. Insulated metallic bushings with grounding lugs as required
   5. Conduit sweeps: minimum 10 times the conduit inside diameter
   6. Include required conduit straps, and hangers, heavy-duty malleable iron or steel
   7. Perforated pipe strap, j-hooks, bridle rings, or wire hangers are not permitted
   8. LB fittings and plastic fittings are not permitted
   9. Nipple runs from one outlet box to another outlet box are not permitted
B. Outlet boxes: Galvanized steel sheet metal 4” x 4” x 2-1/8” deep minimum with single gang mud ring.
C. Pull-boxes: Minimum 14 gauge galvanized steel with screw fastened cover and trim for flush or surface mounting as required for project. Dimensions as required for project.
   1. Box extensions are prohibited for new construction however they are permitted on remodel work to extend existing installations.
D. Metal Flex Conduit (3/4”) and deep Cut-In Boxes for outlets in existing walls for remodel projects only.
E. Pull-String: polypropylene monofilament line with a minimum pull tensile strength of 200 pounds.
F. Cable Trays in Ceiling Areas:
   1. Welded wire mesh cable system 12 standard size with future growth.
   2. Include components, and compatible fittings designed and manufactured by the cable tray manufacturer as required for a fully installed electrically continuous system.
3. Include support kits, brackets, threaded rod hangers, lateral threaded rod braces, and other anchors and supports as required as specified in Section 270500.

G. Labels for conduit, pull-boxes, and cable trays: 1” x 2” yellow background with 3/8” lettering to read “TELECOM”.

2.02 SURFACE METAL RACEWAY SYSTEMS

A. Surface Metal Raceway Systems (SMRS):

1. Surface Raceway: Steel Raceway with Ivory color finish

2. Surface Raceway Parts and Fittings (SRPF):

3. Surface Single gang box to mount faceplate with modular furniture (existing modular raceways shall be used only for pathway).

4. Surface Single gang extension box to mount on surface raceways (the surface raceways shall be used only for pathway).

5. Camera installation:
   i. 4” Octagon Box (see detail).
   ii. 6 3/8” Large round fixture box solid base (see detail).

6. Include all parts and components: base and cover, compatible fittings, insulated bushings, and supports designed and manufactured by the raceway manufacturer as required for a complete installation.

2.03 WIRELESS ACCESS BOXES

A. Wall-Mount Enclosure for Wireless Access Equipment

1. Vented steel closure

2. White, gray, or black finish to match wall color

3. Continuous hinge swing down door with keyed lock

4. Knockouts for cable entry/exit

5. Two 1” antenna openings 5” apart on top of enclosure

6. Include components and compatible fittings from the manufacturer as required for a complete installation

B. Ceiling Enclosure for Wireless Access Equipment

1. Plenum-rated enclosure

2. Mounts in standard 2’ x 2’ or 2’ x 4’ ceiling tile

3. Continuous hinge swing down door with keyed lock

4. Cable entry/exit opening with approved fire-rated foam kits

5. Include equipment mounting plate and other components and compatible fittings from the manufacturer as required for a complete installation
PART 3 - EXECUTION

3.01 INSPECTION
   A. Examine areas and conditions under which the new interior telecommunications pathways are to be installed. Provide notification, in writing, of conditions detrimental to proper completion of the work.
   B. Verify field measurements and pathway routing conditions are as shown on project drawings. Provide notification, in writing, of conditions deviating from drawings.
   C. Beginning of telecommunications pathway installation indicates Contractor acceptance of existing conditions.
   D. Post and comply with: CONSTRUCTION INSPECTION REPORT – VOICE AND DATA COMMUNICATIONS attached to Section 270100.

3.02 INSIDE CONDUIT AND CABLE TRAY INSTALLATION
   A. Place new inside EMT conduit and cable tray systems as shown on the project drawings.
   B. Perform installation of pathways as specified in Section 270500 including anchoring and supports, grounding and bonding, firestop, etc.
   C. No section of conduit shall be longer than 30 m (100 ft) between pull points (e.g., outlet boxes, telecommunications closets, or pull-boxes).
   D. The inside radius of a bend in conduit shall be at least 6 times the conduit internal diameter. Bends in the conduit shall not contain any kinks or other discontinuities that may have a detrimental effect on the cable sheath during cable pulling operations. Some cabling may require larger bends and shall comply with the manufacturers and TIA requirements.
   E. No section of conduit shall contain more than two 90° bends, or equivalent bends exceeding 180° total, between pull points. If there is a reverse (u-shaped) bend in the section, a pull-box shall be installed. Of the 180° offsets, saddles and kicks shall not exceed 30 degrees.
   F. Provide pull-boxes as required to accommodate wire pulling, and code compliance as required due to field conditions for each project.
   G. Install pull-boxes in readily accessible locations. Equipment, piping, ducts, and the like shall not block access to the boxes. Coordinate access doors as required to provide access to pull-boxes in hard ceilings and similar inaccessible areas.
   H. Collector/distribution conduit shall be 25' ± 5 between pull-boxes. Conduits and boxes shall be upsized per fill in area. Install the conduit collector/distribution system so that the electrical continuity of the system for the main feed is maintained.
   I. Conduit, cable tray, and surface raceway shall be so installed, that no cable run shall exceed 290' in length from the Telecommunications Room (TR) or Equipment Room (ER) to the farthest outlet. Where building conditions prohibit meeting this requirement, additional TRs or ERs may need to be provided.
   J. Conduits terminating into cable trays shall be no more than 6” away from the cable tray.
   K. Provide dedicated 3/4” for each telecommunications outlet to the nearest pull-box or cable tray. Where multiple outlets serve an area, a conduit feeder system shall be used based on the attached drawing: TYPICAL TELECOMMUNICATION CONDUIT LAYOUTS. The conduit
feeder system design shall be documented in drawing form and shall be approved in writing by the UCB ITS department prior to installation.

L. Conduit for fire alarm cable shall be separate, dedicated 3/4” conduit for the entire distance from the outlet to the MDF room with 62.5/125 fiber

M. Minimum conduit size for telecommunications shall be 3/4”.

N. Stub out conduits into the TRs and ERs only enough to attach connector and bushings with grounding lugs except conduits shall extend a minimum of 6 inches above the finished floor.

O. The ends of the metallic conduit shall be reamed and bushed using:
   1. Metal bushings for 3/4” and 1” conduit stubs to cable trays
   2. Insulated metallic bushings for 1-1/4” conduit and larger
   3. Insulated metallic bushings with grounding lugs for conduit entering TRs and ERs

P. Cut ends of metallic conduit shall be filed to remove burs.

Q. Bond all metallic raceways (conduit, cable tray, etc.) entering the TRs and ERs to the TGB or TMGMB in the same room with #6 AWG grounding wire as straight as possible.

R. Ceiling tile shall be removed as necessary for the conduit and cable tray installation and put back in place without damaging or dirtying any of the tiles or supporting framework. Ceiling tile shall be handled with clean hands so that no fingerprints or marks are left on the tiles. The contractor is responsible for the cost of repair or replacement of any damaged or dirtied tiles or ceiling hardware.

S. Support conduits above suspended ceilings from building structure by suitable straps, racks, or hangers. Supporting conduits from ceiling suspension wires is not permitted.

T. Provide conduit support within 18” of each termination, and a maximum of 7’ between supports along conduit.

U. Support pull-boxes independently from building construction. Do not support from conduit.

V. Provide conduit expansion fittings with external grounding straps at building expansion joints.

W. Install new pull string in all conduits prior to pulling cable. The pull string shall extend three feet from each end of the conduit and shall be knotted and secured to remain in place.

X. Do not install conduit or cable tray adjacent to hot surfaces or in wet areas.

Y. Install metal flex conduit and deep cut-in boxes for outlets in existing walls for remodel projects only. Connect flex conduit to pull-box within 4’ of entering ceiling space from wall space. Flex conduit and deep cut-in boxes are not allowed in new construction.

Z. Conduit and cable tray sizes and routes and pull-box sizes and locations shall be coordinated with UCB ITS for each project.

AA. If it is necessary to burn holes through webs of beams or girders, receive written approval from UCB as to the location and size of the hole before proceeding with work and abide with UCB standards for this work. All holes shall be burned no larger than absolutely necessary.

BB. Support cable tray with manufacturers supports and/or using threaded, galvanized rod hangers with rods extended through support steel and double-nutted. Size support members within load
rating of member section and without visible deflection. Cut off excess threaded rod ends flush with the bottom of the double nut.

CC. Install cable tray level and straight to the extent possible.

DD. Where cable trays abut walls, supports shall be provided to walls.

EE. Provide cable tray supports at a minimum of 8’ on center and at all intersections and angles.

FF. A minimum of 12” headroom shall be provided above all cable trays.

GG. A minimum of 8” horizontal clearance shall be provided on at least one side of all cable trays.

HH. All cable tray shall be installed in compliance with clearances specified in Section 271500.

II. Install the cable tray system so that the electrical continuity of the system is maintained.

JJ. Provide body expansion connectors for cable trays at building expansion joints.

KK. Provide external grounding strap at expansion joints, sleeves, crossovers and other locations where cable tray continuity is interrupted.

LL. Support racks for telecommunications conduit and or cable tray must be dedicated for telecommunications pathways only. Multi-use suspension systems for plumbing and other piping along with electrical and telecommunications pathways are not permitted.

MM. Coordinate conduit and cable tray runs with other trades.

NN. Label all conduit and cable tray at both ends indicating TR, ER, outlet, or other location where conduit terminates and the length of the conduit. Label pull-boxes indicating destination of conduits entering and exiting.

OO. Label all conduit, pull-boxes, and cable tray with “Telecom” stickers at each end and every 75 feet.

PP. Label conduits entering TRs and ERs in accordance with ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings.

QQ. Separate dedicated pathways (conduit, cable tray, etc.) shall be provided for backbone and horizontal telecommunications cabling. Cable trays shall be clearly divided between backbone and horizontal cabling.

RR. Cable trays shall not pass through any firewall or fire-rated walls or surfaces. Cable tray shall end before the firewall and transition to the EZ Path within six (6) inches of the firewall. The cable through the EZ Path shall not exceed 60% fill, so that and 40% future fill shall remain.

SS. Firestop all pathways and core drills through walls and floors as specified in Section 270500.

3.03 SURFACE METAL RACEWAY INSTALLATION

A. Place new surface metal raceway systems as shown on the project drawings.

B. For outlets in 3000 and 4750 surface raceway, use single-gang extension box on the front of the raceway so jacks do not protrude into pathway as shown in the drawing attached at the end of this Section.
C. Perform installation of routing hardware as specified in Section 270500 including anchoring and supports, grounding and bonding, firestop, etc. Use anchors for attachment to surface. Use of adhesives is prohibited.

D. Collector/distribution surface raceway shall be 25' ± 5 between pull boxes. Surface raceway and boxes shall be upsized per fill in area.

E. Cut raceways square and ream ends to remove burs at raceway connections to outlets.

F. Install raceways parallel or perpendicular to building walls, floors and ceilings.

G. When installing through false ceiling, extend raceway above top of ceiling grid to a pull box feeder system or within 6" of the cable tray. Notch ceiling panel to size of raceway.

H. Coordinate raceway runs with other trades.

I. Ceiling tile shall be removed as necessary for the raceway installation and put back in place without damaging or dirtying any of the tiles or supporting framework. Ceiling tile shall be handled with clean hands so that no fingerprints or marks are left on the tiles. The contractor is responsible for the cost of repair or replacement of any damaged or dirtied tiles or ceiling hardware.

J. Upon request per project and daily installs, the contractor shall coordinate finish selection with the Department of Facilities Management prior to final design. All coordination and disposal cost shall be included in fixed-pricing or project bid.

K. Label all raceway covers on the inside with “Telecom” stickers at each end and every 75 feet. Identify all raceway with Telecommunications labeling as directed by UCB ITS.

3.04 TELECOMMUNICATIONS OUTLETs AND WIRELESS ACCESS ENCLOSURES

A. The locations of outlet boxes and wireless access enclosures shown on project drawings are approximate. The exact location of outlet boxes and enclosures shall be governed by structural conditions, obstructions, or other equipment.

1. Unless otherwise noted, outlet boxes shall be located as follows (dimensions are above finished floor to center line of boxes):
   i. Standard telecommunications outlets: 1'6"
   ii. Wall-mount telephone outlets: 4'6"
   iii. ADA Wall mount telephone outlets: 4'0"

2. All ADA standards shall be met when applicable.

3. Adjust outlet box locations so that they will be symmetrically located and not interfere with other equipment.

4. Where outlets of other types are adjacent, coordinate heights to be similar where possible.

5. Where outlets are located on masonry walls, adjust box location to set in corner of block or brick.

6. Back to back outlet boxes are not permitted. Separate boxes a minimum of 6" in standard walls and a minimum of 2' in acoustical walls.
7. Where conflicts are noted for outlet box locations, coordinate with UCB ITS and Facilities Management.

8. Outlet box locations may be adjusted by UCB up to six (6) feet from the location shown on drawing with no additional cost to UCB.

B. Support outlet boxes independently from building construction. Do not support from conduit or raceways.

C. Install wall-mount and ceiling enclosures for wireless access equipment, including all accessories and firestop materials, in accordance with manufacturer’s specifications. When wireless wall boxes are installed on gypsum board (sheet rock) secure with toggle bolts. After ceiling boxes are installed per manufacturer’s specifications, place on self tapping screw to ceiling grid through each of the support arms.

D. Provide EMT conduit to within 6” of ceiling enclosures for wireless access equipment.

E. Provide EMT conduit connecting to wall-mount enclosures for wireless access equipment.

F. All wireless box installations shall comply with the “Wireless Security Box Instructions” attached to the end of this section.

3.05 AS-BUILT DRAWINGS

A. Mark the project drawings with notations reflecting any variations from the base specifications and drawings including as-built conduit routing.

B. Comply with Construction Drawings AS-BUILT Requirements attached to Section 270100.

APPENDIX FOR EQUIPMENT SCHEDULE:

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<tr>
<th>Line</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
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<td>Wire mesh cable tray – Bend &amp; Intersection Bars</td>
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<td>T-Bar</td>
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<td>6</td>
<td>Wire mesh cable tray – Kwik-Latch Assembly</td>
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<td>28</td>
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SMRS = Surface Metal Raceway Systems
SRPF = Surface Raceway Parts and Fittings
CPI = Chatsworth Products, Inc.

END OF SECTION 27 05 28
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section.

1.02 EMERGENCY FACILITIES

A. Maintain at all times free access to fire lanes and emergency and utility control facilities such as fire hydrants, fire alarm boxes, utility vaults, manholes, pull-boxes, etc.

1.03 SAFETY OF PERSONS AND PROPERTY

A. Initiate, maintain, and supervise all safety precautions and programs in connection with the project work. Comply with all safety precautions and programs of UCB.

B. Take all reasonable precautions for safety of, and provide reasonable protection to prevent damage, injury, or loss to:

1. personnel conducting project work and other persons who may be affected thereby; and
2. existing facilities, whether or not such facility is to be removed or relocated; and
3. project work and all materials and equipment to be incorporated therein, whether in storage or off site, under care, custody or control of Contractor or any subcontractors; and
4. installed equipment and existing construction; and
5. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, fences, roadways, structures and utilities not designed for removal, relocation or replacement in the course of construction.

C. Trucks and other equipment shall not drive on lawns, concrete sidewalks, or concrete curbs unless approved in writing by the UCB Project Manager. All lawns, shrubs, walks, irrigation equipment, tunnels, curbs, or other property damaged in such a manner by the Contractor shall be replaced or repaired in a timely manner by the Contractor to the satisfaction of UCB.

D. Comply with all applicable laws, ordinances, rules, regulations, policies of UCB, and lawful orders of any public authority having jurisdiction for safety of persons or property to protect them from damage injury or loss.

E. Assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety features required to provide safe conditions for all workers and site visitors.

F. Moderate public pedestrian traffic should be expected around all work locations. Ladders, scaffold, installation materials, and all other hazardous conditions must be fully protected at all times. Warning cones, barricades, warning tapes, etc. shall be used to warn and protect persons and property at all times in public corridors.

G. Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection standpipes, hydrants, and exit stairs shall be maintained at all times.
H. Comply with any and all code related and UCB specific safety requirements for work to be performed in confined spaces. The University requires appropriate safety training, physical examination and fit testing for employees working in confined spaces. This shall be provided to Contractor employees at the expense of the Contractor and at no cost to the University.

I. Comply fully with National Electrical Safety Code NESC and UCB specific safety requirements for work in electrical high voltage power manholes. Only licensed electricians may perform work in electrical high voltage power manholes. In addition, a UCB high voltage electrician escort is required to be on site throughout the time work is being conducted by contractors (including standing order electricians) in any high voltage power manholes or vaults.

1.04 LOCATION AND PROTECTION OF UTILITIES
A. Notwithstanding any other provisions of the contract, Contractor shall be solely responsible for location and protection of any and all public lines and utility customer service lines in the work area.

1.05 VEHICULAR ACCESS AND PARKING
A. Provide required parking permits for all construction vehicles furnished by the Contractor. Permits shall be purchased by the Contractor from the University Parking Management Office at 303-492-7384. Any cost to the Contractor for parking related items is not a billable charge.

B. Park only in approved and authorized areas. UCB shall not pay the cost of parking tickets.

1.06 IDENTIFICATION
A. All Contractor personnel shall be clearly identified by uniform and company badge with photo ID.

B. Contractor may also be issued and required to wear UCB provided Contractor ID’s for required card access locations or identification. All owner provided Contractor ID’s must be returned upon completion of the project work.

C. Equip all vehicles with signs identifying the Contractor company. All vehicles used on campus by Contractor personnel, whether owned by the employee or the Contractor shall have visible company identification on both sides of the vehicle. Magnetic signs are acceptable.

1.07 DELIVERY AND STORAGE
A. Make provisions for the delivery and safe storage of all materials and equipment. Specific delivery and storage instructions to be coordinated between UCB and Contractor in advance.

B. Mark materials and store in such manner as to be easily checked and inspected.

C. Store all materials and equipment out of the weather and protected from damage, theft, and vandalism and assume complete responsibility for losses due to any cause. Store materials on dry base at least 6" above ground or floor and provide waterproof covering. Remove and provide special storage for items subject to moisture damage. Replace items stolen or damaged at no cost to UCB.

D. Equipment or materials stored on site shall be stored so as not to interfere with other work, block passageways, or obstruct access/exits to buildings or facilities.

E. Where materials are indicated to be furnished by other or by UCB for installation under this Division, make a complete and careful check of all materials delivered and furnish a receipt acknowledging acceptance of the delivery and condition of the materials delivered. After such
acceptance, assume full responsibility for their safe-keeping until such time as the completed installation has been accepted.

F. Use of trailers may be required. Coordinate with UCB for location of any required trailers.

G. Contractor shall be responsible for all costs associated with materials and equipment delivery and storage.

1.08 SITE ACCESS AND COORDINATION WITH OCCUPANTS

A. Contractor shall have access to site during normal business hours subject to any work restriction for the duration of the project.

B. Perform work in a manner so as to minimize disruption to the ongoing day-to-day activities of the occupants of the facility.

C. Notify UCB to schedule activities that may disrupt the occupants.

D. There are areas of the building where access shall be restricted or regulated due to personnel safety. UCB shall identify such sensitive work areas in which advanced scheduling and admittance permission is required.

1.09 SITE RESTORAL AND CLEANUP

A. Keep the building, premises and surrounding area free from accumulation of surplus, waste materials or rubbish caused by operations at all times.

B. Remove tools, equipment and scaffolding, and leave the area where the work has been done broom clean at the end of each workday. In the case of dispute, the University may remove all such items and charge the cost of such removal to the Contractor.

C. Before leaving each day, remove all surplus material, waste material, empty boxes, crates, and rubbish and transport rubbish to an on-site location designated by the University. All MAC work will not have an on-site location for material. Use of University dumpsters and trash cans is prohibited.

D. Keep clean all equipment and fixtures for the duration of the project.

E. Upon completion of work and before acceptance, remove from the site all surplus and discarded materials, temporary structures, tools, and debris. Surplus and waste materials removed from the site shall be disposed of in accordance with applicable laws and regulations.

F. Equipment shall be turned over to UCB in perfect, unblemished condition.

G. Replace, restore, or bring to original condition any damaged floors, ceilings, walls, furniture, grounds, pavement, etc., caused by Contractor personnel and operations. Restore damage or disfigurements and repair surfaces, including finish and/or paint, to match existing.

H. Upon completion of work and before acceptance, thoroughly clean the entire work area including all equipment and fixtures, both exposed surfaces and interiors. Final cleanup at job completion shall include:

1. Exterior: In addition to items specified below, any new surfaces on exterior, concrete, metal, etc. shall be carefully and thoroughly cleaned.

2. Hardware: Clean and polish all hardware and leave clean and free from paint, grease, dirt, etc.
3. **Electrical:** Clean and polish all electric fixtures, including glassware, switchplates, etc. and leave clean and free from paint, grease, dirt, etc.

4. **Equipment:** Carefully and thoroughly clean all items of equipment, mechanical, electrical, cabinets, ductwork, etc.

5. **Floors:** Thoroughly clean all floors. Vacuum and clean all carpeting. Sweep all hard surface floors.

I. Leave the site in a clean, neat, and orderly condition at least equal to that which originally existed. All final cleanup of the exterior and interior of the building shall be done by the Contractor or by professional cleaners hired and paid for by the Contractor as required.

**PART 2 - MATERIALS**

2.01 THIS SECTION NOT USED.

**PART 3 - EXECUTION**

3.01 THIS SECTION NOT USED.

**APPENDIX FOR EQUIPMENT SCHEDULE:**

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<th>Line</th>
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<th>Manufacturer</th>
<th>Part Number</th>
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END OF SECTION 27 08 00
SECTION 27 11 00 COMMUNICATIONS EQUIPMENT ROOM WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section.

1.02 SCOPE OF WORK

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation within the Telecommunications Rooms (TRs) and Equipment Rooms (ERs) as called for in these specifications and related drawings.

B. This section includes minimum requirements and installation methods for the following:
   1. Equipment Racks and Cable Routing Hardware
   2. Copper Termination Equipment
   3. Fiber Termination Equipment
   4. Grounding and Bonding

1.03 QUALITY ASSURANCE

A. All installation work in the TRs and the ERs shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of UCB.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval of UCB based on submittals provided.

C. Materials and work specified herein shall comply with the applicable requirements of:
   1. ANSI/NFPA 70 – National Electrical Code (NEC) Articles 250, 300, and 645
   2. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
   3. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
   4. ANSI/TIA-568-B.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components, including applicable addendum
   5. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
   6. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces
   7. ANSI/TIA-604 Series – Fiber Optic Connector Intermateability Standards
   8. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
9. ANSI/TIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications

10. BICSI Telecommunications Distribution Methods Manual

11. FCC CFR 47 Part 68 – Connection of Terminal Equipment to the Telephone Network

1.04 DESIGN DOCUMENTATION - GUIDELINES FOR CONSULTANTS

IN REFERENCE TO TELECOMMUNICATIONS DESIGN WORK, THE UNIVERSITY REQUIRES THE TELECOMMUNICATIONS DESIGN EFFORT BE SUBSTANTIALLY COMPLETE AND INCLUDED IN THE PUBLICATION OF THE INITIAL DESIGN DOCUMENTATION SET. THE DESIGN ELEMENTS EXPECTED IN EACH PHASE, AS A MINIMUM, ARE LISTED BELOW. DON'T FORGET TO MAKE IT VERY CLEAR WHAT IS NEW CONSTRUCTION AND WHAT IS NOT WHEN WORKING IN EXISTING LOCATIONS.

A. Schematic Design (SD) Phase

1. Legion or Symbol Schedule complete.

2. Site Plan complete.

3. Specifications will change little and need to be complete for updates.

4. Floor plans shall include outlet locations with numbers for each location (at SD phase the numbers can be XX to indicate numbers will be added on a future phase). Once a number is assigned it shall never change for any reason, a deletion will not change any of the other numbers to keep the numbers consecutive.

5. Riser drawings shall be provided to indicate that the design group understands the project may include OSP ITS copper, OSP Qwest with protection and ITS copper voice, ITS copper utility, copper Qwest to each IDF location.

6. Riser drawing shall be provided to indicate that the design group understands the project may include OSP ITS Multimode(62.5/125) and Singlemode fiber, and then ITS riser Multimode(50/125) Singlemode fiber to each IDF location.

7. Riser drawing shall be provided to indicate the conduits for OSP and risers to include size and quantity.

8. The rack layout is standard for CU ITS and shall be complete at SD phase for review and update. The number of racks may change due to the number of outlets which is acceptable.

9. The MDF voice wall is normally an issue to work through so a wall detail to indicate stacked protectors feed from the bottom at least four high with a ½ D-ring route above the protectors at a height of no more than 6 foot 3 inches all the way across the 66 block run. The next row is 66 blocks stacked 6 high with no gaps feed from the bottom with voice riser cable that will be terminated on the left side first all the way down to the bottom of the sixth block then back to the top and terminated on the right side all the way down to the bottom of the sixth block before terminating on the second row and so on. Then a gap is left for future voice riser and the next row is 66 blocks stacked 6 high with no gaps feed from the bottom with utility riser cable that will be terminated on the left side first all the way down to the bottom of the sixth block then back to the top and terminated on the right side all the way down to the bottom of the sixth block before terminating on the second row and so on.
10. In the MDF on a shorter wall the Qwest protectors are setup like the CU ITS as well as riser however we need one row of six 66 blocks between the protectors and the riser for horizontal station cables that will be terminated on the left side first all the way down to the sixth block on the outside pins only than down the right side of the 66 block on the outside pins only.

11. A note shall be added to the rack detail that “the voice shall be terminated with only one pair per port skipping the 25th pair of each group and the utility shall be terminated with four pair per port skipping the 25th pair of each group. See the patch panel labels for more direction from the CU ITS Project manager.”

12. Cable tray and conduit pathways shall be complete.

13. Details need to be complete – cable tray, ladder rack, outlet box, Ccure, drain box, etc.

B. Design Development (DD) Phase

1. All rooms should be nailed down by now so the Terminal sheets with the floor layout, rack layout, and wall layouts shall be complete to include but not limited to:
   
   i. The ladder racking in each TR.
   ii. The copper and fiber cable routing with the location of the 20 foot coils on the fiber cables shown on the room layout.
   iii. The relay rack locations with the front and back labeled. These shall be next to the wall and working from left to right.
   iv. All grounding detail.
   v. The wall details shall be confirmed for which walls and all numbering added.

2. The outlets need to be numbered if not complete on SD phase.

3. Fine tune any specification needs.

4. Add conduit in location with Gypsum ceilings.

5. Confirm we have enough panels and racks for the number of outlets to be installed.

C. Construction Document (CD) Phase

1. This phase shall only be used for final clean-up

2. When complete email all T dwg CAD files to CU ITS CAD. This is not the As-built files and after construction an As-built set needs to be sent to CU ITS CAD as well.

1.06 ARCHITECTURAL REQUIREMENTS

A. New Telecommunications Rooms (TRs) and Equipment Rooms (ERs) shall be designed in compliance with the space, electrical, and environmental requirements of ANSI/TIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces. Smaller spaces or enclosures shall not be acceptable without prior written approval from UCB ITS.

B. The locations for all TRs and ERs shall be designed to be within a 150’ radius of all areas to be served with the understanding to maintain ANSI/TIA distance standards for telecommunications cabling.

C. Corridor access with the door to swing out is required for all new TRs and ERs, which shall comply with common area access requirements. No other rooms shall lead directly to or from the TR or ER.
D. All walls of the TRs and ERs will be covered with rigidly fixed ¾" A-C fire-resistant or non-combustible plywood backboard, void free, 8' high, painted with two coats of light colored fire retardant paint.

E. TRs and Telecom ERs shall be open to the structure above (no suspended ceiling).

F. The floor, walls and ceiling of the TRs and ERs will be sealed to reduce dust. The floor shall be sealed concrete.

G. The communication TRs and ERs cannot be shared with other departments or purposes including, but not limited to, custodial, access services, electrical, mechanical, storage, etc.

H. Equipment not related to the support of the TR or ER (e.g., piping, ductwork, pneumatic piping, electrical equipment, plumbing, etc.) should not be installed in, pass through, or enter the room.

I. No equipment, hardware, piping, etc. shall be added in or near any TR or ER that will change the temperature or humidity of these rooms without written agreement from UCB ITS department prior to design and installation.

J. The MDF room shall be enlarged to allow future UPS floor space in the footprint. Empty conduits are to be installed running from the UPS location to each data closet. Ensure sufficient wall space is available for future electrical breaker panels that will feed all communication rooms.

K. New TRs and ERs shall not be adjacent to any electrical room or room containing a transformer or motors. Electrical power systems in or adjacent to the TRs and ERs should be configured such that their electromagnetic fields do not interfere with telecom cabling or equipment.

L. Communication as-built files shall be a part of the final punch list and not complete until UCB ITS receives the final as-built cad files (final payment shall be held).

1.07 ELECTRICAL REQUIREMENTS

A. New Telecommunications Rooms (TRs) and Equipment Rooms (ERs) shall be designed in compliance with the space, electrical, and environmental requirements of ANSI/TIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces. Smaller spaces or enclosures shall not be acceptable without prior written approval from UCB ITS.

B. The communication TRs and ERs cannot be shared with other departments or purposes including, but not limited to, custodial, access services, electrical, mechanical, storage, etc.

C. Equipment not related to the support of the TR or ER (e.g., piping, ductwork, pneumatic piping, electrical equipment, plumbing, etc.) should not be installed in, pass through, or enter the room.

D. No equipment, hardware, piping, etc. shall be added in or near any TR or ER that will change the temperature or humidity of these rooms without written agreement from UCB ITS department prior to design and installation.

E. Power for all TRs and ERs in the building will be provided by a separate supply circuit terminated on its own electrical panel with an isolated ground. This electrical panel shall be located in the room with the MDF. If the building is equipped with a standby power generator, the panel serving the TRs and ERs shall be connected to the standby power generator.

F. The MDF room shall be enlarged to allow future UPS floor space in the footprint. Empty conduits are to be installed running from the UPS location to each data closet. Ensure sufficient wall space is available for future electrical breaker panels that will feed all communication rooms.
G. Power for telecommunications and data network equipment in the TRs and ERs should be provided by one (1) double duplex outlet with a dedicated 120VAC, 20A circuit and one (1) L530R outlet with a dedicated 120VAC, 30A circuit located 30 inches behind the relay rack on the wall. In addition, convenience duplex power outlets should be placed at 6 foot intervals on the walls.

H. Lighting in the TRs and ERs should be a minimum of 500 lx (50 foot candles) measured 1 m (3 ft) above the finished floor, mounted 2600 mm (8.5 ft) minimum above the finished floor. Lighting fixtures should not be powered from the same electrical distribution panel as the telecom or data equipment in the room.

I. New TRs and ERs shall not be adjacent to any electrical room or room containing a transformer or motors. Electrical power systems in or adjacent to the TRs and ERs should be configured such that their electromagnetic fields do not interfere with telecom cabling or equipment.

J. Communication cable trays shall be installed in the corridors only with no Sprinklers above the cable tray.

K. A minimum of two 4 inch conduits shall be installed in all gypsum ceilings greater than 3 feet wide and at all corners that are gypsum.

1.08 PLUMBING REQUIREMENTS

A. The communication TRs and ERs cannot be shared with other departments or purposes including, but not limited to, custodial, access services, electrical, mechanical, storage, etc.

B. Equipment not related to the support of the TR or ER (e.g., piping, ductwork, pneumatic piping, electrical equipment, plumbing, etc.) should not be installed in, pass through, or enter the room.

C. No liquid piping, dry liquid piping, drains or steam piping shall pass through or within the walls of any TRs or ERs with the exception of fire safety systems.

D. No equipment, hardware, piping, etc. shall be added in or near any TR or ER that will change the temperature or humidity of these rooms without written agreement from UCB ITS department prior to design and installation.

E. Communication cable trays shall be installed in the corridors only with no Sprinklers above the cable tray.

1.09 MECHANICAL REQUIREMENTS

A. The communication TRs and ERs cannot be shared with other departments or purposes including, but not limited to, custodial, access services, electrical, mechanical, storage, etc.

B. Equipment not related to the support of the TR or ER (e.g., piping, ductwork, pneumatic piping, electrical equipment, plumbing, etc.) should not be installed in, pass through, or enter the room.

C. No liquid piping, dry liquid piping, or steam piping shall pass through or within the walls of any TRs or ERs with the exception of fire safety systems.

D. No equipment, hardware, piping, etc. shall be added in or near any TR or ER that will change the temperature or humidity of these rooms without written agreement from UCB ITS department prior to design and installation.

E. The temperature and humidity in the TRs and ERs should be controlled to provide continuous operating ranges of 64°F to 75°F with 30% to 55% relative humidity. A positive pressure differential with respect to surrounding areas should be provided. If a standby power source is
available in the building, the HVAC system serving the TRs and ERs should be connected to the standby power. HVAC loads will depend on the equipment in these rooms. The equipment list and associated loads will be available upon request from the UCB ITS Networking group.

F. All AC units, VAV and Fan Coil Units shall be located outside the TRs and ERs with only duct work entering the room unless written approval has been given from the UCB ITS department.

G. No liquid piping, dry liquid piping, drains or steam piping shall pass through or within the walls of any TRs or ERs with the exception of fire safety systems.

1.10 COMMUNICATIONS REQUIREMENTS

A. New Telecommunications Rooms (TRs) and Equipment Rooms (ERs) shall be designed in compliance with the space, electrical, and environmental requirements of ANSI/TIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces. Smaller spaces or enclosures shall not be acceptable without prior written approval from UCB ITS.

B. The locations for all TRs and ERs shall be designed to be within a 150’ radius of all areas to be served with the understanding to maintain ANSI/TIA distance standards for telecommunications cabling.

C. All walls of the TRs and ERs will be covered with rigidly fixed ¾” A-C fire-resistant or non-combustible plywood backboard, void free, 8’ high, painted with two coats of light colored fire retardant paint.

D. The communication TRs and ERs cannot be shared with other departments or purposes including, but not limited to, custodial, access services, electrical, mechanical, storage, etc.

E. Equipment not related to the support of the TR or ER (e.g., piping, ductwork, pneumatic piping, electrical equipment, plumbing, etc.) should not be installed in, pass through, or enter the room.

F. No equipment, hardware, piping, etc. shall be added in or near any TR or ER that will change the temperature or humidity of these rooms without written agreement from UCB ITS department prior to design and installation.

G. The MDF room shall be enlarged to allow future UPS floor space in the footprint. Empty conduits are to be installed running from the UPS location to each data closet. Ensure sufficient wall space is available for future electrical breaker panels that will feed all communication rooms.

H. New TRs and ERs shall not be adjacent to any electrical room or room containing a transformer or motors. Electrical power systems in or adjacent to the TRs and ERs should be configured such that their electromagnetic fields do not interfere with telecom cabling or equipment.

I. All CAD design shall comply with the CAD standards document attached at the end of this section. The UCB ITS supplied prints shall be used for design on all projects with updates for each project. The communication design team is responsible for completing the T-5 at CD phase.

J. The UCB ITS standards shall be used for all projects. Items that do not apply to the project can be “strikethrough” and additional information add shall be in the color of red. These specifications shall be email to UCB ITS for all phases of the project including but not limited to SD, DD and CD.

K. The AS-BUILT files shall be the responsibility of the Communication Consulting company to complete not the contractors responsibly. All AS-BUILT files shall be turned into the ITS per these standards.
L. Building designs shall be Star topology with no intermediate cross connect point. All voice, utility, fiber and Qwest shall terminate from the building MDF to a TR.

M. The complete design shall be mailed to UCB ITS on a compact disc or USB drive no later than three weeks following UCB comments.

N. Communication as-built files shall be a part of the final punch list and not complete until UCB ITS receives the final as-built cad files (final payment shall be held).

O. A minimum of two 4 inch conduits shall be installed in all gypsum ceilings greater than 3 feet wide and at all corners that are gypsum.

P. The communication design team shall support and help in the coordination of all of the UCB ITS design team requirements in this section.

Q. Include TR and ER dividing line labeled on both T files and ET files for correct pathway installation.

PART 2 - MATERIALS

2.01 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Floor-Mount Equipment Rack
   1. Standard 19” rack mounting space
   2. 84” high with 44 rack spaces (1 rack space = 1-¾”)
   3. EIA-310-D standard 5/8” 5/8” 1/2” hole pattern
   4. EIA channel width of 3” with double-sided 12/24 tapped screw holes
   5. Lightweight high strength aluminum construction with clear finish
   6. 15” deep base with four (4) ¾” bolt down holes and equipped with hardware for permanent mounting on concrete floor
   7. Rack installation kit
   8. Dust covers for the base off all racks.

B. Vertical Rack Cable Management (for new installations)
   1. 80” high
   2. Slack Loop Storage Organizer, Extended (2”) Mounting Bracket
   3. Cable Retainer

C. Rack Cable Management and Accessories
   1. Interbay Cable Organizer
   2. Screw-Mount, Reusable Cable Ties
   3. Back Wire Manager: 2” Clear Narrow Cable Ring or 4” Doublewide Cable Ring (for remodel projects)
4. Blank Filler Panel, 1, 2, or 4 Rack Units

D. Power Strips
   1. Standard 19” rack-mount power strip with 10 outlets and 10’ cord

E. Ladder Cable Runway
   1. Tube steel painted Gray with cross members welded at 12” intervals:
      i. 6” Wide, 9’ 11-1/2” Length: CPI 10250-106
      ii. 12” Wide, 9’ 11-1/2” Length: CPI 10250-112
      iii. 24” Wide, 9’ 11-1/2” Length: CPI 10250-124
   2. Include support kits, brackets, splice kits, end caps, etc. as required for complete installation.

F. Plywood Backboard: ¾” A-C fire-resistant or non-combustible plywood backboard, void free, 8’ high, painted with two coats of light colored fire retardant paint.

G. ½ D-Rings and D-Rings wall-mount nominal 2” 4” or 6” as required.

H. Velcro cable ties for cable routing and management as required.

2.02 Copper Termination Equipment
A. Category 3 – For Renovations Match Existing and for Additions use 66-type connecting blocks and brackets:
   1. 66 block punch down 66M1-50 style
   2. 89 bracket
   3. 66M cover
   4. Bridge clips

B. Patch Panel: 48-Port Rack Mount Panel

C. Panel for Backbone (Tie) Cable

D. Panel for Utility Cable

E. Building Entrance Protector
   1. 66 block punch to 66 block punch with 5 pin heat coil input.
   2. 66 block punch and 25 foot stub with 5 pin heat coil input.

F. Building Entrance Protector Gas Tube and 4 ohm with 5 pin Heat Coils.

2.03 Fiber Termination Equipment
A. Rack-Mount Lightguide Termination Shelf for Backbone Cable:
   1. 72-Strand Capacity 4U Fiber Fixed Shelf for Module panels
   2. ST Bezel OptiSpeed color Beige with 62.5/125 couplers - 4U MOD Fiber Shelf (for new shelf’s)
3. SC Bezel LazrSpeed color Aqua with 50/125 couplers - 4U MOD Fiber Shelf – (for new shelf’s)
4. ST Bezel TeraSpeed color Blue with Singlemode couplers for 4U MOD Fiber Shelf – (for new shelf’s)
5. 72-Strand Capacity 4U Fiber Fixed Shelf
6. ST Panel for 4U Fiber Shelf – (for LST existing shelf’s only)
7. SC Panel for 4U Fiber Shelf – (for LST existing shelf’s only)

B. Combination Shelf for Fiber Terminations:
1. 24-Strand Capacity 1U Fiber Sliding Shelf for Module panels (use Bezel’s in 2.03 A.)
2. 24-Strand Capacity 1U Fiber Sliding Shelf
3. ST Front panel for the G2 1U Fiber shelf
4. SC Front panel for the G2 1U Fiber shelf

C. ST Multimode Coupling with Hex Mounting Nut for 62.5/125
D. ST Singlemode Coupling with Hex Mounting Nut
E. SC Multimode Duplex Coupling for Laser Optimized 50/125: Systimax C6061A-4-LS

2.04 PATCH CORDS

A. Copper Category 5e, various lengths as required for project:
1. Colored Blue for Voice in TR and ER (NO BOOT)
2. Colored Black for Data in TR and ER (NO BOOT)
3. Desktop Mounting Cord Colored Black for Data at Outlet Location (NO BOOT)
4. Special Circuit Cord Colored Yellow for Circuits other than Voice or Data in TR and ER (NO BOOT)
5. For Housing Only: Colored Gray for Data in TR and ER
6. For Housing Only: Desktop Mounting Cord Colored Gray for Data at Outlet Location
7. For Housing Only: Colored Purple for Ccure and card readers in TR and ER
8. For Housing Only: Colored Orange for Andover and CBORD (dining POS) in TR and ER

B. Copper Category 6, various lengths as required for project:
1. Colored Blue for Voice in TR and ER
2. Colored Black for Data in TR and ER
3. Desktop Mounting Cord Colored Black for Data at Outlet Location
4. Special Circuit Cord Colored Yellow for Circuits other than Voice or Data in TR and ER
5. **For Housing Only: Colored Yellow for Wireless Access Points in TR and ER**

6. **For Housing Only: Video Cameras, Fire, and Health & Safety Colored Red in TR and ER**

C. **Voice Patch Cable from Patch Panel to 66 Blocks (solid not stranded):**
   1. Colored Blue for Voice in TR and ER (Special Order)

D. **Special Circuit Patch Cable from Patch Panel to 66 Blocks (solid not stranded):**
   1. Special Circuit Colored Yellow for Circuits other than Voice or Data in TR and ER (Special Order)

2.05 **GROUNDING AND BONDING**

A. #4 and #6 AWG wire suitable for grounding application.

B. All connectors and clamps shall be mechanical type made of silicon bronze.

C. Terminals shall be solderless compression type, copper long-barrel NEMA two bolt.

D. Telecommunications Bonding Backbone (TBB): Minimum No. 6 AWG insulated copper conductor.

E. Telecommunications Grounding Busbar (TGB): Minimum 6 mm thick x 50 mm wide predrilled copper busbar with standard NEMA bolt hole sizing and spacing

F. All grounding equipment shall be UL listed for that purpose.

**PART 3 - EXECUTION**

3.01 **EQUIPMENT RACKS AND CABLE ROUTING HARDWARE IN TELECOMMUNICATIONS ROOMS**

A. The Telecommunications Rooms (TRs) and Equipment Rooms (ERs) may be equipped with some existing hardware, such as plywood backboards, grounding bus bars, equipment racks, ladder cable runway, horizontal and vertical cable management, and copper and fiber termination equipment. Existing hardware already be in place will be shown on the project drawings.

B. Examine TRs and ERs and verify conditions are as shown on project drawings. Provide notification in writing of conditions deviating from drawings or detrimental to proper completion of the work.

C. Beginning of installation in the TRs and ERs indicates Contractor acceptance existing conditions.

D. Install new equipment racks with vertical and horizontal cable management in the TRs and ERs as required for project and as shown on drawings. Letter designation for racks and equipment shall be placed as shown in the rack layout at the end of this Section and in the panel details at the end of Section 271700. All equipment racks shall be securely anchored to the concrete floor using minimum 3/8" hardware or as specified by rack manufacturer.

E. Install new ladder cable runway for cable routing in the TRs and ERs as required for project and as shown on drawings. All ladder cable runway shall be securely anchored to the walls with support kits and brackets as specified by manufacturer. Secure equipment racks to ladder cable runway with all-thread covered with EMT conduit sleeve.
F. Install plywood backboard on the walls in the TRs and ERs as required for the project and as shown on drawings. All plywood backboard shall be securely anchored to the walls.

G. Install D-rings on plywood backboard for cable routing in the TRs and ERs as required for the project and as shown on drawings.

H. All new cables shall be supported using ladder cable runway, D-rings, and cable management hardware and shall be neatly dressed-out in the TRs and ERs.

I. Clamp all new cables at the entrance to the TRs and ERs for strain relief.

J. Provide coils on all new fiber cables terminated in the TRs and ERs per the project drawings to control excess fiber lengths. TRs and ERs without coils shall be marked “No fiber coil” on the drawings.

K. Bind fiber cable coils in four places with separation of 90 degrees and anchor to wall within four feet of cable entrance. Do not install cable coils on cable or equipment racks.

L. Firestop all sleeves and conduit openings after the cable installation is complete.

M. All building MDFs require one wall-mount telephone outlet on the plywood backboard.

N. The hardware layout in the racks shall follow the UCB standard format from top to bottom and left to right as shown in the typical rack layout drawings.

O. Equipment placement shall be coordinated with UCB ITS staff.

P. Data patch cords being installed to ports on equipment must not cross the center of the port section on the equipment.

Q. Patch cords being installed to jacks on patch panels must not cross the center of the patch panel.

R. Patch cords from equipment ports on one side of the rack to jack patch panel positions on the other side of the rack must route to the vertical manager, up to the top, and over and down the vertical manager on the other side of the rack, so that the patch cords do not cross the center of the patch panel or the center of the port section on the equipment.

S. Patch cords may be installed from equipment ports to jacks on patch panels when the ports and jacks are on the same side of the centerline.

T. A small drip loop is required for trouble shooting and tracing patch cords.

U. Refer to the drawings attached at the end of this section for patch cord routing.

3.02 COPPER TERMINATION EQUIPMENT

A. Some copper termination equipment may already be in place in existing TRs and ERs and will be shown on the project drawings.

B. Mount new 66M1-50 blocks on 89B brackets for backbone (tie), utility, and horizontal telephone cables directly on plywood backboard in the TRs and ERs as required for the project and as shown on drawings. Add bridge clips, cross-connects, and patch cords for all voice installs in immediate communication room prior to final testing for projects and after testing for daily installs and place new clear covers after cable termination and labeling.

C. Mount new patch panels for Category 5e and Category 6 horizontal cables in the floor-mounted equipment racks in the TRs and ERs as required for the project and as shown on drawings.
D. Mount new patch panels for copper backbone (tie) and utility cables in the floor-mounted equipment racks in the TRs and ERs as required for the project and as shown on drawings.

E. Label all copper terminations according to UCB campus standards. The one-page Copper Termination sheet will be provided by UCB ITS and installed by the Contractor. Additional labels needed will be supplied and installed by the Contractor. Replacement sheets will be provided to the Contractor at an additional cost.

F. Provide the copper patch cords for each new horizontal cable to UCB ITS three (3) weeks prior to final acceptance. The patch cords will be installed in the ERs and TRs by UCB personnel. The patch cords will be of adequate length to fit the rack layout without excessive loops. Coordinate the proportion of (data) versus (voice) patch cords with UCB ITS prior to ordering the cords.

G. Provide one desktop mounting cord for each cable in the B, D and F position on the facepate to UCB ITS three (3) weeks prior to final acceptance. The mounting cords will be installed by UCB personnel. The quantity, color, and length of desktop mounting cords will be specified on a per-project basis.

H. The voice patch cords from the patch panel to the 66 block shall be installed prior to testing but not tested through for all projects. These voice patch cables are supplied and installed by the Contractor. The Contractor shall submit the pair count with the jack number for as-built documents at 3 weeks and 1 week prior to occupancy or as specified per project. One end of these voice patch cords is plugged into the patch panel and the other end is punched down. Krone and 110 will also need to include voice patching per project or jack install instruction.

3.03 FIBER TERMINATION EQUIPMENT

A. Some fiber termination equipment may already be in place in existing TRs and ERs and will be shown on the project drawings.

B. Mount new fiber termination shelves in the floor-mounted equipment racks in the TRs and ERs as required for the project and as shown on drawings.

C. Label all fiber enclosures according to UCB campus standards. Fiber schematic sheets and Fiber Termination labels will be provided by UCB ITS and installed by the Contractor. Replacement sheets and labels will be provided to the Contractor at an additional cost.

D. Place dust covers on all ST couplings prior to final acceptance.

E. Paint panels for singlemode fiber terminations yellow according to UCB campus standards.

3.04 GROUNDING AND BONDING

A. Mount new TGBs on plywood backboard in TRs as shown on project drawings. The location for the TGBs shall be coordinated with UCB ITS.

B. Mount new TMGB on plywood backboard in main ER as shown on project drawings. The location for the TMGB shall be coordinated with UCB ITS.

C. Install new TBB from the TMGB in the ER to the TGBs in the TRs as shown on project drawings. Connect the TBB to the TMGB and TGBs in accordance with TIA-607 and NEC. All grounding conductors leaving the ER and TRs shall be in a separate conduit from all communication cabling.
D. Bond all metallic surfaces of new racks, ladder cable runway, and equipment in the TRs and ERs to the TGB or TMGB in the same room with #6 AWG grounding wire as straight as possible.

E. Bond all metallic raceways (conduit, cable tray, etc.) entering the TRs and ERs to the TGB or TMGB in the same room with #6 AWG grounding wire as straight as possible.

F. All grounding items shall be installed in complete compliance with Division 16 – Electrical (or CSI 2004 Division 26 - Electrical) and NEC.

APPENDIX FOR EQUIPMENT SCHEDULE:

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<tr>
<th>Line</th>
<th>Description</th>
<th>Manufacturer</th>
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<tr>
<td>1</td>
<td>Floor-Mount Equipment Rack – 19”</td>
<td>CPI</td>
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<td>Floor-Mount Equipment Rack - installation kit</td>
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<td>3</td>
<td>Dust Covers for floor racks</td>
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<td>41050-119</td>
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<td>Vertical Rack Cable management</td>
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<td>Screw-Mount, Reusable Cable Ties</td>
<td>Hubbell</td>
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<td>7</td>
<td>Back Wire Manager: 2” Narrow Cable Ring</td>
<td>CPI</td>
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<td>8</td>
<td>Back Wire Manager: 4” Doublewide Cable Ring</td>
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<td>Blank Filler Panel 1 - Rack Unit</td>
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<td>Power Strip for 19” racks</td>
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<td>13</td>
<td>Ladder rack 6” wide</td>
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<td>Ladder rack 12” wide</td>
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<td>Ladder rack 24” wide</td>
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<td>Bridge clips</td>
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<td>96 Port Patch Panel – for voice backbone</td>
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<td>48 Port Patch Panel – for utility backbone</td>
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<td>24-strand 1U Fiber Shelf for mods – Mat. ID 760103085</td>
<td>Systimax</td>
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<td>Hubbell</td>
<td>PCX5EBL</td>
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<td>Patch Cords for Data in Black at TR</td>
<td>Hubbell</td>
<td>PCX6xxx</td>
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<td>42</td>
<td>Patch Cords for Data in Black at outlet</td>
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<td>PCX6xxx</td>
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<td>43</td>
<td>Patch Cords for Special Circuits in Yellow at TR</td>
<td>Hubbell</td>
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<td>Patch Cords for Housing Video, Fire and H&amp;S in Red</td>
<td>Hubbell</td>
<td>PCX6Rxx</td>
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<td>Patch Cords for Housing Data in Gray</td>
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<td>Patch Cords for Housing Data in Gray at the outlet</td>
<td>Hubbell</td>
<td>PCX5EGRxx</td>
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<td>47</td>
<td>Patch Cords for Housing Wireless in Yellow</td>
<td>Hubbell</td>
<td>PCX6Yxx</td>
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<td>Patch Cords for Housing Ccure and Card reader in Purple</td>
<td>Hubbell</td>
<td>PCX5EPxx</td>
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<td>TGB – Grounding Busbar</td>
<td>CPI</td>
<td>13622-010</td>
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<td>54</td>
<td>Cable Runway Elevation Kit</td>
<td>CPI</td>
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xx = the length of the patch cord in the size of 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13,14 and 15.

END OF SECTION 27 11 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section.

1.02 SCOPE OF WORK

A. Provide all services labor, materials, tools, and equipment required for the complete and proper installation, splicing, and termination of new backbone cabling as called for in these specifications and related drawings.

B. This section includes minimum requirements and installation methods for the following:

1. Copper Backbone Cabling
2. Copper Splices
3. Fiber Optic Backbone Cabling
4. Fiber Splices
5. Fiber Connectors
6. Coaxial Backbone Cabling

1.03 QUALITY ASSURANCE

A. All backbone cable installation, splicing, and termination shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of UCB.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval of UCB based on submittals provided.

C. Materials and work specified herein shall comply with the applicable requirements of:

1. ANSI/NFPA 70 – National Electrical Code (NEC) Articles 250, 300, 645, and 770
3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
5. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
6. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces
7. ANSI/TIA-598-C – Optical Fiber Cable Color Coding
8. ANSI/TIA-604-3 – FOCIS 3 Fiber Optic Connector Intermateability Standard
9. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
10. ANSI/TIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications
11. ANSI/TIA-758-A – Customer Owned Outside Plant Telecommunications Cabling Standard (including all applicable addenda)
12. ANSI/ICEA S-87-640 – Fiber Optic Outside Plant Communications Cable
13. BICSI Telecommunications Distribution Methods Manual
14. BICSI Customer-Owned Outside Plant Manual

1.04 SUBMITTALS
A. As-built drawings

PART 2 - MATERIALS

2.01 INSIDE COPPER BACKBONE CABLING
A. Riser Rated Non-Plenum (CMR) Category 3 UTP, 24 AWG
   1. 25-Pair
   2. 50-Pair
   3. 100-Pair
   4. 200-Pair
   5. 300-Pair
   6. 400-Pair

B. Riser Rated Plenum (CMP) Category 3 UTP, 24 AWG
   1. 25-Pair
   2. 50-Pair
   3. 100-Pair
   4. 200-Pair
   5. 300-Pair
   6. 400-Pair

2.02 OUTSIDE PLANT (OSP) COPPER TWISTED-PAIR BACKBONE CABLING
A. ASP Filled Core for Buried Installations, 24 AWG
   1. 25-Pair
   2. 50-Pair
3. 100-Pair  
4. 200-Pair  
5. 300-Pair  
6. 400-Pair  
7. 600-Pair  
8. 900-Pair  
9. 1200-Pair

2.03 COPPER SPLICES

A. Splice Closure System for use in manholes and tunnels: 2-Type System  
   1. 2-Type Cover  
   2. 2-Type Endplate  
   3. Washer Cutter Tool Kit

B. Splice Closure System for inside ER and TR’s: Split Sleeve Vault & Riser  
   1. Split Sleeve for 200 Pair  
   2. Split Sleeve for 600 Pair

C. Provide all required hardware and kits for field splicing in splice closures and for sealing and mounting the closures.

D. 710 Splice Module – 25 pair splice connector straight/filled with solid cap

2.04 INSIDE FIBER OPTIC BACKBONE CABBING

A. Single-Mode 8.3/125 Fiber Optic Cable  
   1. 2-Strand Riser-Rated (OFNR)  
   2. 2-Strand Plenum-Rated (OFNP)  
   3. 12-Strand Riser-Rated (OFNR)  
   4. 12-Strand Plenum-Rated (OFNP)  
   5. 24-Strand Riser-Rated (OFNR)  
   6. 24-Strand Plenum-Rated (OFNP)

B. Multi-Mode 62.5/125 Fiber Optic Cable – For Fire Alarm circuits and Existing terminals Only – Coordinated with UCB ITS  
   1. 2-Strand Riser-Rated (OFNR)  
   2. 2-Strand Plenum-Rated (OFNP)  
   3. 12-Strand Riser-Rated (OFNR)
4. 12-Strand Plenum-Rated (OFNP)
5. 24-Strand Riser-Rated (OFNR)
6. 24-Strand Plenum-Rated (OFNP)

C. Multi-Mode Laser Optimized 50/125 Fiber Optic Cable
1. 12-Strand Riser-Rated (OFNR)
2. 12-Strand Plenum-Rated (OFNP)
3. 24-Strand Riser-Rated (OFNR)
4. 24-Strand Plenum-Rated (OFNP)

2.05 OUTSIDE PLANT FIBER OPTIC CABLE

A. Singlemode 8.3/125 TeraSpeed Outside Plant Fiber Optic Cable

1. 6-Strand Dielectric.
2. 12-Strand Dielectric.
3. 24-Strand Dielectric.
4. 36-Strand Dielectric.
5. 72-Strand Dielectric.
6. 96-Strand Dielectric.

B. Multimode 62.5/125 OptiSpeed Outside Plant Fiber Optic Cable — Coordinated with UCB ITS

1. 6-Strand Dielectric.
2. 12-Strand Dielectric.
3. 24-Strand Dielectric.
4. 36-Strand Dielectric.
5. 72-Strand Dielectric.
6. 96-Strand Dielectric.

C. Multimode Laser Optimized 50/125 LahrSpeed Outside Plant Fiber Optic Cable — For approval only — Coordinate with UCB ITS

1. 6-Strand Dielectric.
2. 12-Strand Dielectric.
3. 24-Strand Dielectric.
4. 36-Strand Dielectric.
5. 72-Strand Dielectric.
6. **Strand Dielectric.**

2.06 **FIBER SPLICES**

A. **Splice Closure:**
   1. Fiber Optic Splice Closure.
   2. Fiber Optic Splice Closure fully equipped with cable addition kit.
   3. Fiber Optic Splice Tray and all required accessories for a complete installation.

B. Provide all required hardware and kits for field fusion splicing in splice closures and for sealing and mounting the closures.

2.07 **FIBER CONNECTORS**

A. **Multimode ST II Connector 0.9/2.4/3.0 mm for 62.5/125.**
B. **Singlemode ST II Connector 0.9/2.4/3.0 mm.**
C. **Laser Optimized Multimode SC Connector 0.9 mm: for buffered fiber**
D. **Laser Optimized Multimode SC Connector 3.0 mm.**
E. **Direct Termination Kit for Outside Plant Cable.**
F. **Other consumables and kits as required for field termination of fiber optic cable on connectors.**

2.08 **INSIDE COAXIAL BACKBONE CABLING**

2.09 **ALL COAXIAL BACKBONE CABLE SHALL BE 0.500 NON-FLOODED CABLE. CAMPUS TUNNEL SYSTEMS ARE USED FOR COAXIAL BACKBONE PATHWAYS. THE TUNNELS ARE CONSIDERED ENVIRONMENTALLY CONTROLLED ENVIRONMENTS, SO COAXIAL CABLES WITH BUILT-IN FLOODING COMPOUNDS ARE NOT REQUIRED. PLENUM RATED CABLE IS ONLY TO BE USED WHERE AND WHEN REQUIRED. TYPE RG-11 COAXIAL CABLE SHALL NOT BE PERMITTED IN THIS APPLICATION.**

A. **Riser Rated Non-Plenum (CMR or CATVR) .500 non-flooded cable**
   - Times Fiber T10500J.
B. **Riser Rated Plenum (CMP or CATVP) .500 non-flooded cable**
   - Commscope P3 500 JCAP.

2.10 **COAXIAL DEVICES AND EQUIPMENT**

A. **Amplifiers**
   All amplifiers that are to be tied into the CATV backbone are to be manufactured by Motorola.
   1. “BLE” model shall be used for single output designs
   2. “MB” model for multiple output designs
   3. Forward Passband 52 MHz – 870 MHz (or greater)
   4. Return Passband 5- 40 MHz
B. Optical Nodes connected to CATV backbone and provisioned with 60VAC power
Optical Nodes connecting to the CATV backbone that are provisioned with 60VAC power are to be equipped as follows:

1. 1 GHz Compact Optical Node
2. Forward Passband 47 MHz – 1003 MHz
3. Return Passband 5- 85 MHz

C. Optical Nodes separate from the CATV backbone
Optical Nodes that are separate from the CATV backbone and are used to feed a cable plant isolated to a single building, the following shall apply:

1. Optical Node
2. Minimum gain: 40dB
3. Return transmitter: 1mW, high-gain transmitter

D. Passive Devices for Coaxial Backbone
All passive equipment that is tied into the CATV backbone are to be manufactured by Motorola.

1. Splitters and directional couplers shall be “SSP” model, with a minimum passband upper frequency of 750MHz
2. Taps shall be “FFT” model, with a minimum passband upper frequency of 750MHz

E. Connectors for Coaxial Backbone
1. Gilbert brand connectors are recommended

2.11 BACKBONE CABLE INSTALLATION MATERIALS, EQUIPMENT, AND TOOLS

A. Furnish all required materials, equipment, and tools necessary to properly complete the backbone cabling system installation including, but not limited to: tools for pulling, splicing, and terminating the cables, mounting hardware, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, communication devices, stands for cable reels, cable wenches, etc.

B. Pull rope: 1/4” Nylon pull rope

C. Conduit Caulking Compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.

D. Cable Ties
1. Inside
2. Metallic Ties for Tunnels and Crawl Spaces: to Unistrut Racking

E. Cable Tags: ID Kit
F. “Caution Fiber” Tags: Scotchlite

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which backbone cable is to be installed. Provide notification, in writing, of conditions detrimental to proper completion of the work.

B. Verify field measurements and cable routing and termination conditions are as shown on drawings. Provide notification, in writing, of conditions deviating from drawings.

C. Beginning of backbone cable installation indicates Contractor acceptance of existing conditions.

D. Post and comply with: CONSTRUCTION INSPECTION REPORT – VOICE AND DATA COMMUNICATIONS attached to Section 270100.

3.02 BACKBONE CABELING INSTALLATION

A. Perform all backbone cable installation in conformance with manufacturer’s installation guidelines.

B. Ensure that maximum pulling tensions of specified cables are not exceeded and cable bends maintain the proper radius during placement.

C. Failure to follow appropriate guidelines for cable installation will require the Contractor to provide, in a timely fashion, the additional material and labor necessary to rectify the situation. This shall apply to any and all damages sustained to the cables during installation.

D. Field verify all cable measurements and install all backbone cables in such a matter as to avoid any and all mid-span splices. No mid-span splices are allowed except as specified and shown on project drawings.

E. Pull new pull-rope through all conduit while pulling new backbone cable.

F. The Contractor shall be responsible for all damage to the cable during placement.

G. Do not roll or store cable reels without an appropriate underlay.

H. Clamp all new backbone cables at the entrance facilities for strain relief.

I. Backbone telecommunications cabling shall be placed in dedicated pathways separate from horizontal and other cabling.

J. Backbone cables and splice cases installed in tunnels, crawl spaces and manholes shall be strapped to the cable racks using stainless steel ties.

K. Terminate cables so as not to pull tight on terminating equipment.

L. Ensure that all splice closures are properly sealed for protection of the cable and splices.

M. Neatly and permanently label all backbone cables with the cable number at both ends and at all splice locations.

N. Firestop all sleeves and conduit openings after the cable installation is complete.

O. Plug ends of conduit entering buildings with watertight conduit caulking compound after cable installation is complete to ensure foreign matter does not enter the buildings.
P. Test, label, and document the final backbone cable installation, including cable footages, on the as-built drawings. Standard UCB test sheets and labels can be picked up by contacting the UCB ITS Construction Supervisor at 303-492-8033.

3.03 COPPER UTP BACKBONE CABLE

A. Install copper UTP backbone cabling through conduit, tunnel, and crawl spaces, manholes and other pathways as shown on the drawings.

B. Terminate cable pairs on 66M1-50 connecting blocks in each ERs and TR as shown on the project drawings and following the industry standard color code sequence.

C. Terminate voice backbone (tie) cable pairs on 96-port panels in ERs and TRs as shown on the project drawings. Terminate one pair on each port. Each 25-pair binder group shall have the first 24 pairs terminated on 24 ports in the panel and the 25th pair in each binder group shall remain unterminated.

D. Terminate utility cable pairs on 48-port panels in ERs and TRs as shown on the project drawings. Terminate four pairs on each port. Each 25-pair binder group shall have the first 24 pairs terminated on 6 ports in the panel and the 25th pair in each binder group shall remain unterminated.

3.04 FIBER BACKBONE CABLE

A. Install fiber optic backbone cable through conduit, tunnel, crawl spaces, manholes and other pathways as shown on the drawings.

B. Install service coils with length of 20 feet, and a diameter of 18 inches, at each end of all new backbone fiber optic cables to control excess cable lengths before terminating fiber strands. Do not leave cable slack on walls or ladder racks.

C. Bind fiber cable service coils in four places with separation of 90 degrees and anchor to wall with cable ties within four feet of cable entrance per the drawings. Do not install cable coils on cable or equipment racks.

D. Install fiber connectors in the ERs and TRs as shown on the project drawings.

E. Perform termination of multimode fiber strands on ST II and SC connectors with loss $\leq 0.5 \text{ dB}$ at 850 nm.

F. Perform termination of singlemode fiber strands on ST II and SC connectors with loss $\leq 0.2 \text{ dB}$ at 1310 nm.

G. Terminate fiber strands on connectors and in termination equipment (shelves and panels) as specified in manufacturer’s color code sequence.

H. Do not terminate, splice or cut off “DEAD” cable strands. Neatly coil these unterminated strands inside the shelves or panels with the proper bend radius to protect them for future termination or splicing.

I. Perform fusion splices for multimode and singlemode fiber strands at each splice location with strand numbering as indicated on the drawings.

J. Perform fusion splices for singlemode fiber strands with splice loss $\leq 0.2 \text{ dB}$ at 1310 nm.

K. Perform fusion splices for multimode fiber strands with splice loss $\leq 0.3 \text{ dB}$ at 850 nm.
L. Place “Caution Fiber” tags at all coils and every 50’ along the cable route.

3.05 SAFETY

A. The contractor must comply with UCB regulations for asbestos, lead, and confined spaces (contact EH&S 303-492-0215)

B. Guard manhole openings per NESC C-2-1997, 423.A:
   1. When covers of manholes, handholes, or vaults are removed, the opening shall be promptly protected with a barrier, temporary cover, or other suitable guard.

C. Test for gas in manholes and unventilated vaults per NESC C2-1997, 423.B and C, including, but not limited to:
   1. The atmosphere shall be tested for combustible or flammable gas(es) before entry.
   2. Where combustible or flammable gas(es) are detected, the work area shall be ventilated and made safe before entry.
   3. Unless forced continuous ventilation is provided, a test shall also be made for oxygen deficiency.
   4. Provision shall be made for adequate continuous supply of air. *Note:* The term *adequate* includes evaluation of both the quantity and quality of the air.
   5. Employees shall not smoke in manholes.
   6. Where open flames must be used in manholes or vaults, extra precautions shall be taken to ensure adequate ventilation.

3.06 AS-BUILT DRAWINGS

A. Mark the project drawings with notations reflecting actual cable lengths and any variations from the base specifications and drawings including as-built cable routing.

B. Comply with "Construction Drawings AS-BUILT Requirements" attached to Section 270100.

APPENDIX FOR EQUIPMENT SCHEDULE:

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<th>Description</th>
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<th>Part Number</th>
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<td>Mohawk</td>
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<td>3M</td>
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### BACKBONE CABLING REQUIREMENTS

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<tr>
<th>No.</th>
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<td>Multimode ST II Connector 62.5/125 Mat.</td>
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<td>Laser Optimized Multimode SC Connector 0.9 mm: Mat.</td>
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<td>Times Fiber</td>
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<td>Metallic Ties for Tunnels and Crawl Spaces for CATV</td>
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<td>“Caution Fiber” Tags.</td>
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END OF SECTION 27 13 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section

1.02 SCOPE OF WORK

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation and termination of new horizontal “station” cabling as called for in these specifications and related drawings.

B. The horizontal portion of the telecommunications cabling system extends from the work area telecommunications outlet to the termination in the Telecommunications Room (TR) or Equipment Room (ER).

C. This section includes minimum requirements and installation methods for the following:
   1. Copper Horizontal Cabling
   2. Fiber Optic Horizontal Cabling
   3. Work Area Faceplates
   4. Copper Modular Jacks
   5. Fiber Modular Jacks and Connectors
   6. Coaxial Horizontal (Drop) Cabling

1.03 UCB WIRELESS DESIGN GUIDELINES / NEW CONSTRUCTION BUILDINGS

A. University of Colorado Boulder Campus new construction buildings will include Project IT funds to engage an 802.11 wireless engineering vendor to perform 802.11 RSSI 3-D modeling to determine Access Point (AP) placement and radio frequency propagation based on the modeling software and proposed building design blueprints. Vendor will be proficient in the use of Motorola designed “Enterprise Planner” modeling software. The modeling software will provide 3-D multi-floor results. The vendor will be supplied with the latest version CAD drawings for the new construction building to be used in the modeling process. ITS Operations’ preferred vendor for this application is Polycom. The vendor will provide as a deliverable a full report from the modeling engagement including Access Point location placement, RSSI with heat maps detailing wireless data rates, SIR interference heat maps, and channel and power plan for each building floor. The report will include all heat maps, material lists and executive summary detailing the parameters used for the modeling setup. The report will be submitted with a minimum two hard copies and on electronic CD. ITS Operations will review the finished report before Architect/Contractor engages cable plant design to accommodate AP placement. For questions related to this document please call (303) 735-7000, or Ext 57000 using a campus based telephone.

1.04 QUALITY ASSURANCE

A. All horizontal “station” cable installation and termination shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of UCB.
B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based on the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval of UCB based on submittals provided.

C. Materials and work specified herein shall comply with the applicable requirements of:

1. ANSI/NFPA 70 – National Electrical Code including, but not limited to, the following articles:
   i. 300 – Wiring Methods
   ii. 645 – Information Technology Equipment
   iii. 725 – Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits
   iv. 770 – Optical Fiber Cables and Raceways
   v. 800 – Communications Circuits

2. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA-568-B.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components, including applicable addendum
5. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
6. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces
7. ANSI/TIA-604 Series – Fiber Optic Connector Intermateability Standard
8. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
9. ANSI/ICEA S-83-596 – Fiber Optic Premises Distribution Cable
10. BICSI Telecommunications Distribution Methods Manual

1.05 SUBMITTALS

A. As-built drawings (as required per Section 270100 or per attached document “Construction Drawings AS-BUILT Requirements”)

PART 2 - MATERIALS

2.01 COPPER HORIZONTAL CABLING

A. Category 5e, 4-Pair UTP Cabling – For New Installations and Additions/Renovations – Coordinated with UCB ITS
   1. Inside Rated (CM), Blue Sheath Color.
   2. Plenum Rated (CMP), Blue Sheath Color.

B. Category 6e+, 4-Pair Horizontal Cabling – For New Installations by approval from UCB ITS
   1. Inside Rated (CM), Green Sheath Color.
2. Plenum Rated (CMP), Lime Sheath Color.

C. For Housing Only:
   Category 6, 4-pair Horizontal Cabling — For New installations with Video Cameras, Fire, and Health & Safety
   1. Inside Rated (CM), Red Sheath Color.
   2. Plenum Rated (CMP), Red Sheath Color.

D. For Housing Only:
   Category 6, 4-pair Horizontal Cabling — For New installations with Wireless Access Points
   1. Inside Rated (CM), Yellow Sheath Color.
   2. Plenum Rated (CMP), Yellow Sheath Color.

E. For Housing Only:
   Category 5e, 4-pair Horizontal Cabling — For New installations with Ccure and card readers
   1. Inside Rated (CM), Purple (Violet) Sheath Color.
   2. Plenum Rated (CMP), Purple (Violet) Sheath Color.

F. For Housing Only:
   Category 5e, 4-pair Horizontal Cabling — For New installations with Andover and CBORD (dining POS)
   1. Inside Rated (CM), Orange Sheath Color.
   2. Plenum Rated (CMP), Orange Sheath Color.

2.02 FIBER OPTIC HORIZONTAL CABLING

A. Multimode (50/125) 2-Strand Inside Distribution Cable for Fire Alarm and Andover
   1. Laser Optimized multimode, graded-index optical fiber waveguide in accordance with TIA-492AAAC
   2. Core Diameter: 50 ± 2 µm
   3. Cladding Diameter: 125 ± 1.0 µm
   4. Minimum Bandwidth Information Transmission Capacity for Overfilled Launch: 500 MHz-km at 850 nm and 500 MHz-km at 1300 nm
   5. Minimum Bandwidth Information Transmission Capacity for LASER Launch using Differential Mode Delay (DMD): 700 MHz-km at 850 nm
   6. Maximum fiber loss: 3.5 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm
   7. Specifically designed and Manufacturer guaranteed for 10 Gbps Ethernet performance for 150 m distances using serial 850 nm electronics.
   8. Riser Rated (OFNR).
B. Multimode (62.5/125) 2-Strand Inside Distribution Cable
   1. Riser Rated (OFNR): OptiSPEED PVC
   2. Plenum Rated (OFNP): OptiSPEED

2.03 COAXIAL HORIZONTAL CABLING AND CONNECTORS
A. Coaxial RG-6
   1. Inside Rated (CM or CATV).
   2. Plenum Rated (CMP or CATVP).
   3. Connectors used for terminations shall be:
      Thomas and Betts Snap-N-Seal or
      Stirling SPL – other 360-degree true radial compression connectors will be accepted
      providing that they meet industry standards. Hex-crimp connectors will not be
      accepted.

2.04 WORK AREA FACEPLATES
A. Hubbell Modular Flush-Mount Faceplates – For New Installations
   1. Single gang with 6 jack openings (holes)
   2. Designed for use with modular jacks specified
   3. Flat with slots to cover screws and to house white labels and covers
   4. Electrical Ivory color
B. Hubbell Blank Covers for Faceplates – For New Installations
   1. Designed to fit jack opening in modular faceplate
   2. Electrical Ivory color
C. Surface Housing for Wireless Access Boxes
   1. One-Port for modular outlet jack, Office White Color.
D. Wall Phone Faceplates
   1. Stainless Steel Recessed Plate.
E. Floorbox Outlet Frame.
F. Floorbox Outlet Faceplate (to be used with outlet frame).

2.05 COPPER MODULAR JACKS
A. Category 3, 8-Position, 8-Conductor Jack – For replacement to Match Existing – Coordinated
   with UCB ITS
   1. T568B wiring
   2. Supports minimum of 750 plug insertions
3. Designed to fit opening in modular faceplate
4. Electrical Ivory color

B. Category 5e, 8-Position, 8-Conductor Jack – For New Installations and Additions/Renovations to Match Existing – Coordinated with UCB ITS

1. Designed to support applications up to 1 Gbps
2. T568B wiring
3. Supports minimum of 750 plug insertions
4. Designed to fit opening in modular faceplate
5. Gray color for typical voice and data.
6. Green color for all Labs as approved from UCB ITS

C. Category 6e+, 8-Position, 8-Conductor Jack – For Special installations as approved from UCB ITS.

1. Designed to support applications up to 1.2 Gbps
2. T568B wiring
3. Supports minimum of 750 plug insertions
4. Designed to fit opening in modular faceplate
5. Blue color

D. For Housing Only
Category 6, 8-Position, 8-Conductor Jack – For New Installations and additions/renovations

1. Designed to support applications up to 1.2 Gbps
2. T568B wiring
3. Supports minimum of 750 plug insertions
4. Designed to fit opening in modular faceplate
5. Red color: with Video Cameras, Fire, and Health & Safety
6. Yellow color: with Wireless access points

E. For Housing Only
Category 5e, 8-Position, 8-Conductor Jack – For New Installations and additions/renovations

1. Designed to support applications up to 1 Gbps
2. T568B wiring
3. Supports minimum of 750 plug insertions
4. Designed to fit opening in modular faceplate
5. Purple color: with Ccure and card readers
6. Orange color: with Andover and CBORD (dining POS)

2.06 FIBER ADAPTERS AND CONNECTORS FOR OUTLETS
A. Multimode SC modular adapter (coupling) to fit faceplate for fiber jacks
B. Laser Optimized Multimode SC Connector 0.9 mm: for buffered fiber, plus other consumables and kits as required for field termination of fiber optic cable on connectors

2.07 INSTALLATION MATERIALS, EQUIPMENT, AND TOOLS
A. Furnish all required materials, equipment, and tools necessary to properly complete the horizontal copper, CATV coaxial and fiber optic cabling system installation including, but not limited to: tools for pulling and terminating the cables, mounting hardware, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, communication devices, stands for cable reels, cable wenches, etc.
B. Pull-string: polypropylene monofilament line with a minimum pull tensile strength of 200 pounds.

PART 3 - EXECUTION
3.01 INSPECTION
A. Examine areas and conditions under which horizontal cable is to be installed. Provide notification, in writing, of conditions detrimental to proper completion of the work.
B. Verify cable routing and termination conditions are as shown on drawings. Provide notification, in writing, of conditions deviating from drawings.
C. Beginning of horizontal cable installation indicates Contractor acceptance of existing conditions.
D. Post and comply with: CONSTRUCTION INSPECTION REPORT – VOICE AND DATA COMMUNICATIONS attached to Section 270100.

3.02 HORIZONTAL CABLE INSTALLATION
A. Install faceplates and copper and fiber jacks at each work area outlet location as indicated on the project drawings. Place the jacks in the faceplates beginning with position A and placing the copper jacks before the CATV coaxial and/or fiber adapter jacks. Place blank covers in the unused openings on each faceplate.
B. All faceplates shall have a minimum of two cables and jacks with the exception of wall plates (have one drop), wireless access points (have one drop), and Housing dorm rooms (have three drops).
C. Faceplates shall be secured with mechanical fasteners. Adhesive fasteners shall not be allowed.
D. Install one surface housing and one Category 5e jack in each wireless access box.
E. Install copper and fiber optic horizontal cable from each work area outlet location indicated on the drawings to the nearest TR or ER as indicated on the project drawings.
F. Perform all horizontal cable installation in conformance with manufacturer’s installation guidelines.
G. Ensure that maximum pulling tensions of specified cables are not exceeded and cable bends maintain the proper radius during placement.
H. For outlet locations in walls, floor, and overhead, the horizontal cable distribution design uses conduit or surface raceway to the outlet location with conduit, surface raceway, and/or cable tray in the ceiling space to the TR or ER. Coordinate as necessary with electrical contractor for placement of horizontal cable pathways and outlet boxes.

I. Horizontal telecommunications cabling shall be placed in dedicated pathways separate from backbone and other cabling.

J. All horizontal cabling terminating within a single faceplate must be routed to and terminated in the same ER or TR.

K. Install new pull-rope in all conduits while pulling in new horizontal cables.

L. Ceiling tile shall be removed as necessary for the cable installation and put back in place without damaging or dirtying any of the tiles or supporting framework. Ceiling tile shall be handled with clean hands so that no fingerprints or marks are left on the tiles. The contractor is responsible for the cost of repair or replacement of any damaged or dirtied tiles or ceiling hardware.

M. For cable penetration of ceiling tiles, the holes must be placed along the ceiling tile edge.

N. All cables in the ceiling space:
   1. shall be supported in conduit or in the cable tray and shall not droop or hang outside of cable tray;
   2. shall not be run “wild” (unsupported by conduit or cable tray) for distances greater than six inches;
   3. shall not be attached to the suspended ceiling structure or laid directly on the ceiling grid as a means of support;
   4. shall not be supported by or attached by any means to fire sprinkler heads or delivery systems, any environmental sensor, or the exterior of any conduit or raceway;
   5. shall be routed at right angles to the electrical power circuits where the cable is not enclosed in conduit or in cable tray.

O. Where specifically allowed by UCB ITS, cable hangers shall be specifically designed and installed for the purpose of supporting telecommunications cables. The hangers shall be attached to the building structure and framework at a maximum of five-foot intervals. Existing bridle rings may be left in place to support existing cables that are not removed. Bridle rings shall not be used to support new cables.

P. All cables in the ceiling space and cable tray shall be bundled with plenum rated cable ties snug, but not deforming the cable geometry. Cable bundles shall have no more than 32 cables per bundle.

Q. The total length of any horizontal station cable from the jack location to the termination block shall not exceed 90 meters.

R. Maintain the following clearances from EMI sources:
   1. Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: 12”
2. Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: 24”

3. Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: 6”

4. Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: 12”

5. Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: 3”

6. Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: 6”

7. Fluorescent fixtures near cable in open or non-metal pathway: 12”

8. Fluorescent fixtures near cable in grounded metal conduit: 6”

9. Motors or transformers near cable in non-metal pathway: 48”

10. Motors or transformers near cable in grounded metal pathway: 36”

S. Manage slack to avoid excess cable or kinking.

T. Cable shall not be exposed along route.

U. Do not splice or bridge tap the cable.

V. All cables shall be tied and dressed neatly with a minimum bend radius of 10 times the cable diameter. Provide necessary hardware to maintain proper bend radius at corners.

W. All cables shall be firmly held in place. Fastenings and supports shall be adequate to support loads with ample safety factors.

X. All ladders used for cable installation shall be padded on both ends and shall be carried by two people when moved within the building.

Y. Failure to follow appropriate guidelines for cable installation will require the Contractor to provide, in a timely fashion, the additional material and labor necessary to rectify the situation. This shall apply to any and all damages sustained to the cables during installation.

Z. The Contractor shall be responsible for all damage to the cable during placement.

AA. Cables with jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper (shinners) shall be replaced.

BB. Do not roll or store cable reels without an appropriate underlay.

CC. Neatly and permanently label all horizontal cables with the cable number at both ends.

DD. Firestop all sleeves and conduit openings after the cable installation is complete.

EE. Test, label, and document final horizontal cable installation including outlet numbering on as-built drawings.
FF. Remove existing cable and terminations that will no longer be used as specified and shown on project drawings. Coordinate as necessary with electrical contractor for removal of existing horizontal cable pathways and outlet boxes.

GG. All wireless box installations shall comply with the “Wireless Security Box Instructions” attached to the end of Section 270528.

3.03 COPPER CABLE TERMINATION

A. At the work area outlet, terminate all pairs of the each copper horizontal cable on the jack with TIA T568B pin-pair assignments.

B. Terminate all pairs of each copper horizontal cable on patch panels or new 66-type connecting blocks with only 3 pair terminated in most existing terminals on 66-type connects. Match existing termination practice for 66-type installation unless prints note differently.

C. All cables shall be terminated so as not to pull tight on the terminating equipment.

D. Do not untwist cable pairs more than 0.5 inches when terminating.

3.04 INSIDE FIBER OPTIC HORIZONTAL CABLING

A. Perform termination of multimode horizontal fiber strands on SC connectors at each end with loss ≤ 0.5 dB at 850 nm.

B. At the work area outlet, place two SC connectors with terminated fiber cable strands in the two SC adapter jacks in the faceplate.

C. In the TR or ER, place the two SC connectors with terminated fiber cable strands in the SC adapters in the termination shelf.

D. All cables shall be terminated so as not to pull tight on the terminating equipment.

3.05 COAXIAL HORIZONTAL CABLING

A. All drops are to be home-run from the distribution tap to the face plate with no drop splitters or amplifiers to be used. Variations of this requirement requires express written approval from the UCB CATV group.

B. Drop connectors shall be compression type as listed in the previous section “Part 2 - Products” above. “Hex-crimp” connectors are not allowed.

C. Connector type is to be determined by the cable type being terminated.

3.06 AS-BUILT DRAWINGS

A. Mark the project drawings with notations reflecting actual cable outlet numbering and any variations from the base specifications and drawings.

B. Comply with Construction Drawings AS-BUILT Requirements attached to Section 270100.
### APPENDIX FOR EQUIPMENT SCHEDULE:

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Manufacturer</th>
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<td>Housing, Category 5e – Orange Inside Rated</td>
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<td>6 gang Modular Flush-Mount Faceplates</td>
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<td>Blank Covers for Faceplates</td>
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<td>Surface Housing for Wireless Access Boxes</td>
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<td>Wall Phone Faceplates – Stainless steel</td>
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<td>Floorbox Outlet Frame</td>
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SECTION 27 15 00

HORIZONTAL CABLING REQUIREMENTS

END OF SECTION 27 15 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section

1.02 SCOPE OF WORK
   A. Provide all services, labor, materials, tools, and equipment required for complete and proper testing, certification, identification, and administration of the installed telecommunications cabling as called for in these specifications and related drawings.
   B. This section includes minimum requirements and installation methods for the following:
      1. Copper Cable Testing and Testers
      2. Fiber Optic Cable Testing and Testers
      3. Labels and Labeling
      4. Documentation

1.03 QUALITY ASSURANCE
   A. All testing procedures and testers shall comply with applicable requirements of:
      1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
      2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
      3. ANSI/TIA-568-B.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components, including applicable addendum
      4. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
      5. TIA-455 Series – Fiber Optic Test Procedures
      6. TIA-526 Series – Optic Fiber Systems Test Procedures
      7. TSB 140-04 – Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
   B. Identification and administration work shall comply with applicable requirements of:
      1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
      2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
      3. ANSI/TIA-568-B.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components, including applicable addendum
      4. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
      5. ANSI/TIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces
6. ANSI/TIA-598-A – Optical Fiber Cable Color Coding
7. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
8. BICSI Telecommunications Distribution Methods Manual
9. UCB ITS Standards for Identification and Administration

1.04 SUBMITTALS
A. Test reports (including fiber pre-test sheets)
B. As-built drawings
C. The Consultant shall submit the proposed outlet numbers, using the T-5 template provided by ITS, for review and approval prior to construction.

PART 2 - MATERIALS

2.01 COPPER CABLE TESTERS
A. Test equipment and field test instruments shall meet requirements for ANSI/TIA-568-B.2 Annex B and Annex I.
B. Physical interface shall be modular RJ-45 connector and a serial port with DB-9 connector.
C. Store test results including date stamp of tests and UCB jack designator for each tested link.
D. Print test results in report form when connected to a PC.
E. Have auto-testing to determine if cable meets requirements of ANSI/TIA-568-B.2 Annex B and Annex I, 10Base-T, Fast Ethernet, Gigabit Ethernet, and ATM standards.
F. Measure NEXT for all pair combinations and Attenuation on all pairs from 1.0 to 350 MHz.

2.02 OPTICAL FIBER CABLE TESTERS
A. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIAA-526-14-A.
B. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/TIA/EIAA-526-7.
C. Multimode Light Source
   1. Meet the launch requirements of ANSI/TIA-455-78B achieved within the field test equipment or by use of an external mandrel wrap (as described in clause 6.4 of ANSI/TIA-568-C.0) with a Category 1 light source.
   2. Provide stabilized 850 nm and 1300 nm +/- 20 nm wavelength LED light source
   3. Spectral width of sources shall be \( \leq 50 \text{ nm} \) of 850 nm wavelengths and \( \leq 140 \text{ nm} \) for 1300 nm wavelengths
   4. Output of light source shall be 8 MW for 62.5 or 50 \( \mu \text{m} \) core optical fiber as appropriate
   5. Output stability +/- 0.40 dB from 0 to 50 degrees C
6. Long term output stability +/- 0.10 dB at 25 degrees C
7. Connector types shall include: ST and SC

D. Singlemode Light Source
1. Provide stabilized 1310 nm and 1500 nm +/- 20 nm wavelength Laser light source
2. Output stability +/- 0.40 dB from 0 to 50 degrees C
3. Long term output stability +/- 0.10 dB at 25 degrees C
4. Connector types shall be ST

E. Optical Power Meter
1. Calibrated against National Institute of Standards and Technology (NIST) standard.
2. Provide 850 nm, and 1300 nm +/- 20 nm selectable wavelength test capability
3. Measurement range from 10 to –60 dBm
4. Accuracy +/- 5% at 0 to 50 dBm
5. Accuracy +/- 10% 10 to 0 dBm and –50 to –60 dBm
6. Resolution 0.01 dB
7. Connector types shall include: ST and SC

F. Optical Time Domain Reflectometer (OTDR)
1. Dual selectable wavelength: 850/1300 nm for multimode
2. Dual selectable wavelength: 1310/1550 nm for singlemode
3. Selectable Cable Index of Refraction
4. Visual fault locator for continuity checks and dead zone fault location
5. Front display and printer connection for hard-copy documentation
6. Equipped with launch jumper cable of sufficient length to offset entry “dead zone”
7. Connector types shall include: ST and SC

2.03 LABELS

A. Faceplate labels shall be printed and supplied by the Contractor with a Dymo Electronic Labelmaker 5000 or equivalent with prior approval from UCB ITS.

B. The one page Copper Termination sheet and Fiber Termination Labels will be provided by UCB ITS and installed by the Contractor. All additional labels needed shall be supplied and installed by the Contractor. Replacement sheets and labels will be provided to the Contractor at an additional cost.

C. Labels for cable marking: vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide
cable label with printing area that is any other color than white, preferably orange or yellow - so that the labels are easily distinguishable.

D. Pre-printed labels shall meet legibility, defacement, exposure and adhesion requirements of UL 969.

E. Hand written labels are not allowed.

F. Cable ID tags

PART 3 - EXECUTION

3.01 COPPER CABLE TESTING

A. Test 100% of installed backbone copper cabling for:
   1. Wire Map
   2. Length

B. Perform the following Permanent Link tests for 100% of installed copper horizontal cabling as described in ANSI/TIA-568-C.1, Section 6.3 and ANSI/TIA-568-B.2, Annex E:
   1. Wire Map
   2. Length
   3. Insertion Loss
   4. Pair-To-Pair NEXT Loss
   5. Propagation Delay
   6. Delay Skew

C. Perform the following Permanent Link tests for 100% of installed Category 5e and Category 6 horizontal copper cabling as described in ANSI/TIA-568-C.0, Section 6.3 and ANSI/TIA-568-B.2 Annex E:
   1. PSNEXT Loss
   2. Pair-To-Pair ELFEXT
   3. PSELFEXT
   4. Return Loss

D. Cross-connects from horizontal to backbone cabling will not be in place for these tests.

E. The wire map test shall verify pair to pin termination at each end and check for connectivity errors. The wire map shall indicate the following for each of the eight conductors:
   1. Continuity to the remote end
   2. Shorts between any two or more conductors
   3. Reversed pairs
   4. Split pairs
5. Transposed pairs

6. Any other miswiring

F. The maximum length of the permanent link for horizontal cable shall be 90 meters. Shorten any cable runs as required at no additional cost to UCB.

G. Replace and or repair cable and terminations as necessary to assure 100% passing performance specifications.

H. Final testing shall be scheduled and conducted in the presence of the UCB ITS representative as specified in Section 270100.

I. Submit electronic and printed test results reports for each copper cabling permanent link to UCB before project is closed.

3.02 OPTICAL FIBER CABLE TESTING

A. Test all fiber optic cable strands for continuity and performance before and after the cables are pulled and terminated.

B. Test link attenuation of all installed multimode fiber optic strands after splicing and termination in accordance with ANSI/TIA-568-C.0, Section 6.4 and Annex E, and TSB-140.

1. One direction with an optical light source and an optical power meter.

2. Test at two wavelengths to account for attenuation differences due to wavelength:
   i. 850 nm and 1300 nm for multimode strands
   ii. 1310 nm and 1550 nm for singlemode strands


4. For multimode strands, wrap reference jumper around mandrel to remove high-order mode transient losses as specified in ANSI/TIA-568-C.0, Section 6.4, Table 3.

5. Test Singlemode strands in accordance with TIA-526-7, Method A.1, One Reference Jumper.

6. The total attenuation budget for each fiber cable length (end-to-end) shall equal the allowed attenuation for the fiber (0.2 dB per km times the length in km) plus the attenuation for each splice and connector. For example, a cable length of 3 km with 1 splice and 2 connectors would have an attenuation budget of (3 km x 0.2 dB/km) + (2 x 0.2 dB) = 1.2 dB.

C. Test all installed fiber optic strands after splicing and termination with an OTDR (Optical Time-Domain Reflectometer) per TIA-455-61 and TSB-140:

1. End-to-end bi-directional signature trace with fault finding, connection point reflections, fiber bend, pressure point locations, etc.

2. One wavelength, 1300 nm for multimode strands.

3. One wavelength, 1550 nm for singlemode strands.

4. Multimode fiber connector losses ≤ 0.5 dB at 850 nm
5. Singlemode fiber connector losses ≤ 0.2 dB at 1310 nm
6. Multimode fiber splice losses ≤ 0.3 dB at 850 nm
7. Singlemode fiber splice losses ≤ 0.2 dB at 1310 nm
8. Localized attenuation shall not exceed 0.5 dB at any point

D. Fibers that are broken or damaged shall be replaced at no cost to UCB and replaced fiber optic cables shall be re-tested.

E. Final testing shall be scheduled and conducted in the presence of the UCB ITS representative as specified in Section 270100, 1.7. Complete and submit the fiber pre-test sheet prior to scheduling the final testing. The fiber pre-test sheet is attached to the end of this Section.

F. Submit electronic and printed OTDR test results reports for each fiber optic cable strand to UCB before project is closed.

3.03 HORIZONTAL CABLE IDENTIFICATION AND LABELING:

A. Neatly and permanently label all copper and fiber optic cables with the cable number at both ends.

B. The UCB standard outlet numbering plan to be used for labeling faceplates, 66-blocks, patch panels, and fiber terminations is described in the attached document Labeling and Testing.

C. The identification and labeling for all copper and fiber optic cables and TR/ER terminations shall be clearly labeled and approved by UCB ITS 3 weeks prior to customer move occupancy.

3.04 AS-BUILT DRAWINGS

A. Mark the project drawings with notations reflecting any variations from the base specifications and drawings including as-built numbering for the outlets on the floorplans.

B. Comply with Construction Drawings AS-BUILT Requirements attached to Section 270100.

APPENDIX FOR EQUIPMENT SCHEDULE:

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END OF SECTION 27 17 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Contract Forms, Conditions of the Contract, including Construction Manager/General Contractor (CM/GC) Agreement including Exhibits and other Division 1 Specification Sections, apply to this section

1.02 SCOPE OF WORK

A. The work covered by this Division consists of furnishing all services, accessories, connectors, supports, electrical protection, equipment, tools, setup, preparation, labor, supervision, incidentals, transportation, storage, and related items and appurtenances, and performing all operations necessary to complete the Data Communications system work as indicated in the project drawings and specified herein. UCB Information Technology Services will supply the Data Communications devices required for this project.

B. It is the intent and purpose of this specification to have, upon completion of the project, a “turn-key” Data Communications system that is designed, built, coordinated and integrated as necessary with the existing telecommunications infrastructure (e.g. existing data network elements) and complete and operable in all respects. Completely install, connect, and test all systems, equipment, devices, etc., shown or noted or required to final connections and leave ready for satisfactory operation. Provide any minor items omitted from the design, but obviously necessary to accomplish the above intent.

C. All work shall be conducted in coordination with the UCB Information Technology Services and other building trades.

D. All data communication system designs for UCB buildings on and off campus must be approved by the UCB ITS department for standard and design structure. Any design outside of these standards must be approved and include a written agreement for the design from the UCB ITS department.

E. The project supplies funds for the networking equipment and the equipment is owner supplied. The equipment consists of routers, firewalls, switches, and access points.

1.03 QUALITY ASSURANCE, REGULATIONS AND CODE COMPLIANCE

A. All installation work shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of UCB.

B. Materials and work specified herein shall comply with the applicable requirements of:

1. ANSI/NFPA 70 – National Electrical Code (NEC) Articles 250, 300, and 645
2. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA-568-B.2 – Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted-Pair Cabling Components, including applicable addendum
5. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
6. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces
7. ANSI/TIA-604 Series – Fiber Optic Connector Intermateability Standards
8. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure of Commercial Buildings
9. Americans with Disabilities Act (ADA)
10. UCB Standards

C. References to regulations, codes, and standards mean the latest edition, amendment and revisions to the regulations, codes and standards in effect on the date of the Contract Documents.

D. All work and materials shall conform to and be installed, inspected, and tested in accordance with the governing rules and regulations of federal, state, and local government agencies.

E. All modifications required by the referenced codes, rules, regulations, and authorities shall be made by the Contractor without additional charge to UCB.

F. Report immediately to UCB ITS personnel and/or the Consultant/Engineer, in writing, any part of the data communications design which does not conform to the requirements of these codes or regulations, or otherwise be held responsible to provide and install material which will comply with these codes and regulations.

G. Applicable codes and ordinances and local interpretations take precedence when they conflict with or are more stringent than the data communications design. Drawings and specifications take precedence where design is more stringent than codes and ordinances.

PART 2 - MATERIALS

PART 3 - THE PROJECT SUPPLIES FUNDS FOR THE DATA COMMUNICATIONS EQUIPMENT AND THE EQUIPMENT IS OWNER SUPPLIED. THE DATA COMMUNICATIONS EQUIPMENT CONSISTS OF ROUTERS, FIREWALLS, SWITCHES, AND ACCESS POINTS. ALL OTHER MATERIALS NECESSARY FOR THE INSTALLATION OF THE DATA COMMUNICATIONS SYSTEM ARE TO BE PROVIDED BY THE CONTRACTOR.

3.01 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. All materials and equipment shall be new, free from defects, installed in accordance with manufacturer’s current published recommendations in a neat manner and in accordance with standard practices of the industry.

B. Where no specific material, apparatus, or appliance is mentioned, any standard, first-class product made by reputable manufacturer regularly engaged in the production of such material may be used providing it conforms to the contract requirements and meets the approval of UCB ITS Personnel and/or the Consultant/Engineer.

C. Materials shall meet or exceed the following minimum requirements:

1. Where applicable, all materials and equipment shall bear the label and listing of UL. Application and installation of all listed equipment and materials shall be in accordance with such labeling and listing.
2. Equipment shall meet all applicable FCC regulations.

3. Electrical equipment and systems shall meet UL standards and requirements of the NEC. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

4. Materials and equipment shall bear the manufacturer’s name or trademark and model/serial number permanently marked.

3.02 CABLES

A. All UTP cable inside the building shall be UL listed and marked type CM, CMR, or CMP and shall be installed in accordance with NEC articles 300-22, 800-49, 800-50, 800-51, 800-52, and 800-53.

B. All fiber optic cable inside the building shall be UL listed and marked type OFN, OFNR, or OFNP and shall be installed in accordance with NEC articles 300-22, 770-49, 770-50, 770-51, 770-52, and 770-53.

3.03 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

3.04 SPECIAL TOOLS AND KITS

A. The Contractor shall furnish any special installation equipment, tools, or kits necessary to properly complete the data communications system installation. This may include, but is not limited to, tools for pulling, splicing, terminating, and testing the cables, communication devices, stands for cable reels, cable wenches, assembly and adjustment devices, etc.

PART 4 - EXECUTION

4.01 GENERAL INSTALLATION REQUIREMENTS

A. The approximate locations of existing and new telecommunications outlets, cabling and equipment will be indicated on the project drawings; however, the drawings may not give complete information for the specific work location. Contractor is responsible to field verify existing outlets and cabling prior to submitting quote. Determine the exact location after thoroughly examining the general building plans and by actual measurements before and during construction, subject to the approval of UCB and/or the Consultant/Engineer.

B. Before construction work commences, visit the site and identify the exact routing for all data communications cable pathways and equipment placement. Verify all dimensions, locating the work and its relation to existing work, all existing conditions and their relation to the work and all man made obstructions and conditions, etc. affecting the completion and proper execution of the work as indicated in the project drawings and specifications.

C. If core drills are required, the exact core locations shall be identified and coordinated with the UCB Asbestos Management plan as necessary.

D. All equipment locations shall be coordinated with UCB, other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.

E. Install data communications cabling and equipment to facilitate maintenance and repair or replacement of equipment components. Provide easy, safe and code mandated clearances at
equipment racks and enclosures, and other equipment requiring maintenance and operation. Coordinate with UCB exact location and mounting height of all equipment in finished areas, such as equipment racks, termination equipment, communication and electrical devices. As much as practical, connect equipment for ease of disconnecting, with a minimum of interference with other installations.

F. Coordinate ordering and installation of all materials and equipment with long lead times or having major impact on work by other trades so as not to delay the job or impact the schedule. Coordinate delivery of UCB provided Data Network Equipment.

G. Provide all scaffolding, rigging, hoisting and services necessary for delivery, installation, and erection of materials, equipment, and apparatus furnished into the premises. These items shall be removed from premises when no longer required. With the exception of UCB provided Data Network Equipment provided as part of this project, use of University owned supplies and equipment is prohibited.

4.02 WORKMANSHIP

A. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.

B. Good workmanship and appearance shall be considered of equal importance with Data Communication systems operation. Lack of quality workmanship shall be considered sufficient reason for rejection of a system in part or in its entirety. Carefully lay out all work in advance and install in a neat and workmanlike manner in accordance with recognized good practices and standards. Provide workmen who are skilled in their craft and a competent Project Manager who will be on the job at all times.

APPENDIX FOR EQUIPMENT SCHEDULE:

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>Manufacturer</th>
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END OF SECTION 27 20 00
Memorandum of understanding between the University of Colorado at Boulder (UCB) Information Technology Services (ITS), and the Contractors to the University of Colorado Telecommunication Department on all construction drawings issued for projects on Campus.

1. The UCB ITS CAD department shall issue two sets of drawings to the Contractor for ITS projects. Drawings for outside contractors, (i.e. not engineered by UCB ITS) shall be issued by the Architect/Consultant or Facilities Management Project Manager for Facilities Management projects. Contractors may receive additional drawings. One set of drawings shall be kept on the job site for the purpose of marking as-built variations on the drawings. Drawings override any verbal statements made prior to, or during project walk-through, unless they are written on the drawing and a UCB ITS signature is next to the change.

2. Any changes (i.e. redlines) made to the design will need to be directed to the UCB ITS Engineering Department or the appropriate change order process. Changes made to the drawings shall require a UCB ITS signature next to redlines allowing the change to be made. If there is any change in cost of the project, a written submittal must be approved by UCB Project Manager before proceeding. The Contractor may be requested to verify existing layout. Redlines on the drawings, based on field verification, shall not require a UCB ITS signature next to the redlines. Indicate “field verified” next to the redlines.

3. All copper/fiber and conduit jobs shall have cable and conduit distances noted on the “Cable Footage and Count Information” sheet. Footages from end-to-end, between splices, and from splice to building fiber termination point in building (relay rack or fiber can) are required. The “SYM” column on the form corresponds to the fiber and copper designation bubbles on the topo drawings. Conduit type and length shall be noted on the topo drawings.

4. The UCB ITS Project Manager or UCB ITS Construction staff shall conduct an as-built walk-through with the Lead Contractor prior to project completion. During this walk-through a punch list shall be developed and the accuracy of the redline changes will be determined.

5. All drawings issued are required to be returned to the UCB Project Manager, whether or not as-built modifications (redlines) were made to the drawings.

6. The UCB ITS Project Manager and UCB ITS Construction will sign the prints after the punch list has been completed according to UCB drawings and specifications. As-built drawings for outside contracts shall be returned to the Architect/Consultant (or General Contractor depending on the project). Copies of the floor plans (i.e. jack maps) and jack position sheets shall be given to the UCB ITS Project Manager prior to returning as-builts to the Architect/Consultant per this division standard.

7. The UCB ITS CAD department maintains the right to return drawings to the Contractor if information is incorrect or missing. The UCB ITS CAD Department is responsible for the accuracy of UCB ITS CAD drawings and shall require accuracy and clarity on all as-built drawings received from contractors and Architects/Consultants. Architects/Consultants shall provide UCB ITS CAD Department with both paper and electronic as-builts for a project.

8. The statement “Completed Per Print” is not acceptable.

Last document update was April 6, 2010.

Jerry Roehrs - Project Manager
Robin Aragon - Construction
Don Thomas - Engineering Department

Outside Plant Contractor
Inside Contractor
Project Contractor (Bid Jobs)
Cable Footage and Count Information

<table>
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<th>FOOTAGE</th>
<th>CABLE TYPE</th>
<th>CABLE COUNT</th>
<th>DESTINATION</th>
<th>TOPO PG</th>
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<th>CA AFTER</th>
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Provide footage or measurement location.
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Wireless Ceiling and Wall Security Box instructions for the
University of Colorado at Boulder

The purpose of this document is to give directions of how to use and install wireless access point security boxes on the University of Colorado at Boulder campus. It includes how contractors should mount boxes at CU and how employees of CU mount wireless access points in these security boxes.

Prepared By Bill Franz
Network Engineer
Information Technology Services

Modified By Max Lopez
May 13th, 2009
Senior Wireless Engineer
Information Technology Services
**Wall Box Specifications** –

**Part#:**
- 6090-White (Matte White Paint Color)
- 6090-Black (Black Textured Paint Color)
- 6090-Gray (Profile Gray Textured Paint Color)

**Manufacturer:**
H.O.M.E. INC
PO BOX 225
500 West 9th Street
Phone: 800 745 7011
Fax: 573 486 5737
www.home-inc.net

**Background:** These boxes were designed by Bill Franz of Information Technology Services Network Engineering and Operations to secure Cisco 1200 series wireless access points. They are a custom design available only from H.O.M.E INC. See Figure 1-1 for a sketch.

**Drilling Instructions:**
When mounting wall boxes from HOME INC there only a few locations to drill knock out holes. The red dots on Figure 1-2 are the locations on these wall boxes that the contractor is allowed to drill holes to mount the jack conduit and feed to jack into the wall box. If any holes are drilled between the predrilled antenna holes either on the back of the box or the side of the box the contactor will have to redo the work.

**Mounting Instructions:**
The directions of how the wall boxes should be mounted will be provide by ITS on the contract drawings.

**Wall Mounts:**
Antenna holes are located on two opposite sides of the wall box. The wall box needs to be installed so that the end with the holes closer together are facing upward. Alternately, when the wall box is in this orientation, the door hinge will be at the top.

When installing the wall box, ensure to leave clearance for the antennas. Wall boxes need to be installed with 12'' of clearance from the top of the wall box to the ceiling.
Ceiling Mounts:
To mount the wall box on a hard deck ceiling you have four options (hinge NORTH, hinge SOUTH, hinge EAST, hinge WEST). Keep in mind that on these wall boxes the hinge is mounted on the side of the box with oval holes. Visualize the box touching the ceiling with the hinge facing the desired directions.

The ceiling mounts are different from the wall mounts in that whatever direction you mount the box the space requirements remain the same. When mounting a wall box on the ceiling the contractor must leave 3” of open space in front of the predrilled antenna holes.

Instructions for ITS employees:
These new wall boxes will not need a blue console cable in each of the wall boxes. There should be plenty of space to plug a console cable in. To install Cisco 1200 access points into this box put the access point into the wall box and attach and 802.11a and the 802.11b/g antennas. Once the antennas are installed wrap one insulation foam donut around each of the antennas inside the box to secure the antennas inside the box.

Parts needed per box:
4 - ¾” wide insulation foam donuts. To make these donuts buy a 36” tube pipe insulation with 5/8” wall thickness from a hardware store. Cut the tube into ¾” wide donuts. Each 36” tube should make enough donuts for 11 or 12 wall boxes.
Figure 1-2
Ceiling Box Specifications –

**Part#:**
WA064-CAP-R113

**Manufacturer:**
American Access Technologies Inc.
6670 Spring Lake Road
Keystone Heights, FL 32656
Phone: 352 473 6673
Fax: 353 473 6572

**Distributor:**
Chatsworth Products Inc.
31425 Agoura Road
Westlake Village, CA 91361
Phone: 818 735 6100
Fax: 818 735 6199

**Background:**
The original American Access box design (WA064-CAP) was modified by Bill Franz of Information Technology Services Network Engineering and Operations to secure Cisco 1200 series wireless access points. They are a custom design available only from American Access Technologies via Chatsworth Products Inc. See figure 2-1 for a sketch.

**Preparation instructions:**
All ceiling boxes must get certain hardware mounted in ceiling box BEFORE the box is mounted in a ceiling tile.

Essential equipment:
2 rubber grommets (for a 7/8” hole with 1/8” groove and a 5/8” hole in the middle)
2 10/24” X 2” bolt
2 #10 Lock washer
2 10/24” nut

The rubber grommets need to be installed in the round holes of the boxes that face up into the ceiling when the box is installed. The 10/24” bolts can be screwed directly into the 5/32” diameter holes on the ceiling facing side of the box. When installed properly and bolts should be sticking into the box down toward the ground. Once the bolts are installed put a #10 lock washer on each of the bolts and then add the 10/24” nuts. Tighten nuts as much as possible to lock the bolts in place.
**Mounting Instructions:**
To mount the ceiling box follow the instructions provided with each box. If instructions are not provided with the ceiling box please contact American Access Technologies and have them fax or email instructions immediately. Any incorrectly installed ceiling boxes must be corrected by contractor at the contractor’s expense. Feed the jack cabling through the cabling box at the end of the ceiling box highlighted in red in figure 2-2.

**Instruction Instructions for ITS employees:**
These ceiling boxes will not need a blue console cable. There should be plenty of space to plug a console cable in. To install Cisco 1200 access points screw on all of the antennas to the Cisco 1200 wireless access point. Once the antennas are attached place the access point into the ceiling box between the bolts with the Cisco logo facing down toward the ground. Then feed the antennas through the antenna holes. Place steel piping strap over the access point and attach it to the bolts. Then screw on the 10/24” wing nuts on the bolts until the access point is secured.

**Parts needed per box:**
- 2 rubber grommets (that fits in a 7/8” hole with 1/8” groove and a 5/8” hole in the middle)
- 2 10/24” X 2” bolt
- 2 #10 Lock washer
- 2 10/24” nut
- 2 10/24” wing nuts
- 8” of steel piping strap
Figure 2-1

1" WIDE PIANO HINGE, FULL LENGTH OF DOOR. SPOT WELDED TO BOX AND LD. HINGE TO BE WELDED ON SIDE OF BOX NEAREST CABLE ENTRANCE.
Figure 2-2

1" WIDE PIANO HINGE, FULL LENGTH OF DOOR. SPOT MIG/ERN TO TOP AND U/D. HINGE TO BE MOUNTED ON SIDE OF DOOR NEAREST CHELLE ENTRANCE.
FIGURE 1 - OUTDOOR WIRELESS BOX INSTALL DETAIL

NTS - FOR CONCEPTUAL PURPOSES ONLY

*DRAWING IS TO BE USED AS A GUIDELINE FOR CONCEPTUAL PURPOSES ONLY. IT IS UP TO THE INSTALLER TO SPECIFY AND FOLLOW ANY CODE ISSUES SUCH AS WATER PROOFING OR FIRE RATING FOR EACH SPECIFIC PROJECT. CONSULT WITH ITS STAFF IF THERE ARE ANY QUESTIONS.
*Drawing is to be used as a guideline for conceptual purposes only. It is up to the installer to specify and follow any code issues, such as water proofing or fire rating for each specific project. Consult with its staff if there are any questions.
Labeling and Testing

**Base:** The base section is just an introduction of the numbering of work-area outlets at the UCB (University of Colorado at Boulder). Although UCB numbers the work-area outlets in the database and expects this on the “Jack Position Sheet,” not all information is always applied (i.e. on work-area outlet). The numbering will include:

1) Communication room number.
2) Block or rack & panel. For CATV, this will indicate distribution tap number by showing tap number followed by the suffix “tv”. – See attachment 1.
3) Position on the block or panel.
4) Work-area jack associated to the outlet letters A through F.
5) Medium.
   a. C3 = category 3
   b. 5E = category 5e
   c. C6 = category 6
   d. TV = cable television
   e. M5 = multimode 50/125 micro n.
   f. M6 = multimode 62.5/125 micro n.
   g. S = singlemode
6) Block or rack & panel.
7) Position on the block or panel.
8) Ownership information for specific types of outlets when applicable.

*See Attachment #1 for sample.*

Note numbers 1, 2, and 3 are all the same per each jack within an outlet for A through F.

**Work-Area Outlet:** The work-area outlet number will include:

1) Ownership information if applicable
2) Communication room number.
3) Block or rack & panel.
4) Position on the block or panel.

This information is taken from the station wire in the A position of the work-area outlet and this is the only number on the work-area outlet (i.e. 210 – 1 – 2 or 210-1D-20).

*See Attachment #2 for sample.*
Labeling and Testing

Note: *Use Dymo Electronic Labelmaker 5000 (or equivalent) to print labels.
     *Hand-written labels are not allowed.

66 Block: The 66 blocks have the following labeling:

Used for all Location

1) The left ear of each 66 block will be labeled with the block and wiring field letter designation (i.e. A1 or B1, A2 or B2). The ‘1’ or ‘2’ indicates the block number & ‘A’ indicates voice field Cat 3 & ‘B’ would indicate data field Cat 3. Other tags may be ‘U’ for utility and ‘T’ for tie.

Used in Main Location with category 3

2) On the left side of a 66 block in the MAIN, the station blocks are labeled with the first pair (w/b) of all station wire and the communication room number. An ‘L’ is used in the block and position to indicate the left side (i.e. 1L-1A), “RM” for room, and the room number the work-area outlet is located in. Work all the way down the left side 1L-1A to 1L-8A, 2L-1A to 2L-8A, etc., before starting the right side. If a Cat 3 cable does not go to the A position on the work-area outlet then label the 66 block appropriately (i.e. 1L-1A, 1L-1B, 1L-1C, 1L-1D, etc.)

Used in Main Location with category 3

3) On the right side of the 66 blocks in the MAIN, the station cable blocks are labeled the same but using R in the block and position to indicate the right side and the work-area jack position [A-F] (i.e. 1R-1A), “RM” for room and the room number the work-area outlet is located in. Work all the way down the right side 1R-1A to 1R-8A, 2R-1A to 2R-8A, etc. Again, if a Cat 3 cable does not go to the A position on the work-area outlet then label the 66 block appropriately (i.e. 1R-1A, 1R-1B, 1R-1C, 1R-1D, etc.).

Used in Main Location with category 3 and in TR (Telecommunications Room) for category 3 riser with category 6 on patch panels (known as jack is a jack).

4) All riser cable will have the riser count on the block for the correct cable pair number, starting with the first pair number and every third pair (i.e. 1, 4, 7, 10, 13, 16, 19 and 22). Count will start on the top left working down towards the bottom and then to the right side of the first block and down towards the bottom of each row.
Labeling and Testing

See Attachment #3 for sample.

Used in TR Location with category 3

1) The left ear of each 66 block will be labeled with the block and wiring field letter designation (i.e. A1 or B1, A2 or B2). The ‘1’ or ‘2’ indicates the block number & ‘A’ indicates voice field Cat 3 & ‘B’ would indicate data field Cat 3. Other tags may be ‘U’ for utility and ‘T’ for tie).

Used in TR Location with category 3

2) All riser cable is punched down only on the left side and will have the riser count on the block for the correct cable pair number starting with the first pair number & every third pair afterwards (i.e. 1, 4, 7, 10, 13, 16, 19, and 22).

Used in TR Location with category 3

3) On the right side of the 66 blocks the station cables are labeled at the first pair (w/b) of all station wires with the communication room. The block number and the position and the jack position [A-F] (i.e. 1 – 1A), “RM” for room & the room number the work-area outlet is located in. Work from top to bottom and from left to right. If a Cat 3 cable does not go to the A position on the work-area outlet then label the 66 block appropriately (i.e. 1-1A, 1-1B, 1-1C, 1-1D, etc.).

Used in TR (Telecommunications Room) for category 3 riser with category 6 on patch panels (known as jack is a jack).

4) All riser cable will have the riser count on the block for the correct cable pair number, starting with the first pair number and every third pair (i.e. 1, 4, 7, 10, 13, 16, 19 and 22). Count will start on the top left working down towards the bottom and then to the right side of the first block and down towards the bottom of each row.

See Attachment #4 for sample.

Patch Panel:  Patch panels are numbered by the number that is on the work-area outlet followed by the jack association letter, but the communication room number is not on the patch panels. Each panel is labeled with:

1) A letter that reflects its position on the rack.

2) The block or rack and panel of the station cable that is in the A position of the work-area outlet.
Labeling and Testing

3) The position on block or panel of the station cable that is in the A position of the work-area outlet.

4) The letter designation of the jack where this station wire lands in the work-area outlet (i.e. A – F).

5) The “RM” with the room number that the work-area outlet is located in.

See Attachment #5 for sample.

Note: *Use Dymo Electronic Label-maker 5000 (or equivalent) to print labels.
*Hand-written labels are not allowed.

Krone Block: Krone blocks should be numbered and terminated left to right per block and left to right per rack. The numbering is similar to the patch panel layout.

300-Pair 4-Pair Color Coded Kit

1) The cable ID and pair count is listed for each pair.

8 Pair Ultim8 Blocks

1) Each block is labeled with the block number and the Riser ID with the pair count on the top label of the 8 pair Ultim8 blocks.

2) Label each 8 pair Ultim8 block on the front of the top row, as follows:
   a) Block or rack and panel of the station cable that is in the A position of the work-area outlet.
   b) Position on block or panel of the station cable that is in the A position of the work-area outlet.
   c) The letter designation of the jack where this station wire lands in the work-area outlet (i.e. A – F).
   d) “RM” with the room number that the work-area outlet is located in.

See Attachment #6 for sample.

(All labels for Krone sold separately!)

110 Block: 110 Blocks are numbered per 100 pair on the square next to the first row of each 100 pair.

See Attachment #8 for sample.

1) Jack ID numbering is similar to the patch panel.
Labeling and Testing

a) Each station cable will get all 4-pairs terminated and will be labeled Block #, Position # 1-6 per row and up to 24 per block, and room # jack is in the “A” position.

b) If a cable is added to an existing outlet, the cable ID in the TR will need to reflect the faceplate “A” position and faceplate position being added. Example: 1-1B, 1-1C, 1-1D, 1-1E or 1-1F.

2) Riser or tie cable shall be labeled every 5th pair and marking the first pair of each 25 pair group.

*See Attachment #9 for sample.*

3) When 110 hardware is used, jacks are not dedicated to a riser count. A cross connect is necessary to connect from a riser pair to a jack.

**Jack Position Sheets:** All projects need to include an as-built Jack Position Sheet, to be given to the ITS Telecom project manager. The Jack Position sheet will need to include the numbers assigned to it from the print, the room number from the prints and all fields of data for each station wire (i.e. 177 – 1 – 1 AC3 – 1 – 1

177 – 1 – 1 BC6 – 1D – 2).

The electronic file of T-5 template.xls is the required Jack Position Sheet to be used and should be received from ITS department prior to construction.

*See Attachment #7 for sample.*

**Protectors:** The cable count and pairs are labeled on each protector (i.e. 11, 1 – 100 broken out for each protector).

**Riser Copper Sheet:** The MAIN will have a master list for all the riser pairs and each TR will have the riser count for that room. This is a 24” x 36” CAD print known as the Copper Sheet.

**All Cables:** All exposed cables need to be labeled with cable type, cable ID, and count before & after every splice, when leaving or entering the building & in communication rooms, tunnels, and all man holes or hand holes.

**CATV coax label:** The labeling on the coax in the terminal room at the distribution tap needs to be printed as a two-line label. Line 1 will show jack number, followed by room number (where jack is located). Line 2 will show CATV tap information.

Example: 135 – 1D – 8 Rm 271
Labeling and Testing

135 – 1tv-1
Labeling and Testing

JACK NUMBERING PLAN

OUTLET # DATABASE INFORMATION ONLY
135-1D-8A5E
135-1D-8B5E-1A-16
135-1D-8CTV-1TV-1
135-1D-8D
135-1D-8EM5-1D-22
135-1D-8FM5-1D-23

CLOSET
BLOCK OR RACK & PANEL
BLOCK OR PANEL POS.
OUTLET POSITION
MEDIA TYPE
BLOCK OR RACK & PANEL
BLOCK OR PANEL POSITION

* OWNERSHIP INFORMATION = THE LABELING OF OUTLETS FOR ALLIANCE NETWORK, LABS AND QWEST
JACKS SHALL INCLUDE THE FOLLOWING PREFIXES BEFORE THE CLOSET NUMBER ON THE OUTLET:

AN = ALLIANCE NETWORK
LB = LABS
QW = QWEST

ATTACHMENT #1
jkplan-08.dwg
Labeling and Testing

Typical Jack Examples

NOTE: OWNERSHIP INFORMATION — THE LABELING OF OUTLETS FOR ALLIANCE INFORMATION, LBG AND QWEST OUTLETS SHALL INCLUDE THE FOLLOWING PREFIXES BEFORE THE CLOSET NUMBER ON THE OUTLET:

AN = ALLIANCE NETWORK
LB = LBS
GW = QWEST
RN = RISENET

Telephone Production Faceplate

Telephone Faceplate Drawing Notes

1. USE DUST COVERS FOR ALL UNPOPULATED SLOTS. FOLLOW UCB JACK NUMBERING PROGRAM FROM TELECOMMUNICATION DEPARTMENT. BRACKET REPRESENT OLD INFORMATION TO BE CHANGED.

2. WHEN THIS POSITION IS CABLED THE TERMINATION HARDWARE IS LABELED WITH THE "A" POSITION AND THE FACEPLATE POSITION EXAMPLE 10-1C, 1-10, 1-1E, OR 1-1F.

3. FACEPLATE SHALL BE LABELED PER CU STANDARDS DAVISON 27117D. BRACKETS ARE USED TO SHOW THAT THE FACEPLATE NUMBER IS CHANGING EXAMPLE: CSL(096-4-3) NEW 210-10-1

Attachment #2

jkplan-09.dwg
Labeling and Testing

EXAMPLE: The position is used for a wall jack.

This is an example of how to tag the block so that the position is not used when a single voice cable is installed.

EXAMPLE: This position is used for a coax reader.

EXAMPLE: The position is used for a wall jack.

EXAMPLE: The position is used for a wall jack.

EXAMPLE: The position is used for a wall jack.
Labeling and Testing

VOICE/DATA PATCH PANEL

VOICE PUNCHED — ONE PAIR

UTILITY PUNCHED — FOUR PAIR

TELEPHONE PATCH PANEL

ATTACHMENT #5
Labeling and Testing

KRONE

B PAIR ULTIM8 BLOCKS
NOT TO SCALE

300 PAIR 4 PAIR COLOR CODED KIT
NOT TO SCALE

ATTACHMENT #6
Inform Labeling
## Labeling and Testing

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Labeling and Testing

110 BLOCK RISER/TIE CABLE LABELING EXAMPLE.

ATTACHMENT #9

110 BLOCK RISER-TIE LABELING EXAMPLE.dwg
Labeling and Testing

Prior to Test, Check List

1. For all new fiber installs:
   a. Fiber labels
   b. Numbers on 10A/1000ST panels
   c. Single mode panels painted \textit{YELLOW}
   d. Racks, shelves and panels properly lettered
   e. Coils permanently mounted
   f. Floor cleaned-up and trash emptied

2. Testing day:
   a. Keys for terminals
   b. Communication devices for testing purposes
   c. Working test equipment
   d. Two knowledgeable testers & ITS Rep.

Note: If all above mentioned items are not completed, you are not ready to test.
Labeling and Testing

Check List (Fiber)

1. For all fiber upgrades and installs:
   a. Place all labels in terminals affected
   b. Label racks, shelves and patch panels correctly
   c. Place cable tags as specified in this document
   d. Place numbers to the left on the 1000 ST panels
   e. Place coupler grooves to the top when installing
   f. Single Mode panels ONLY to be painted YELLOW
   g. Mount fiber coils permanently per print
   h. Clean terminal and empty trash

2. Test Day Bring:
   a. Keys for the terminals
   b. Communication devises for testing purposes
   c. Working test equipment
   d. Two knowledgeable testers and an ITS Rep will meet you at the location

NOTE: If all the above-mentioned items are not completed, you are not ready to test!
Labeling and Testing

Check List (Copper)

1. For all copper upgrades and installs:
   a. Place all new copper sheets in terminals affected
   b. Label racks, shelves and patch panels correctly
   c. Place clear plastic covers on all 66 blocks
   d. 66 blocks numbered correctly
   e. Clean terminal and empty trash
   f. Pre-test completed?

2. Test Day Bring:
   a. Keys for the terminals
   b. Communication devises for testing purposes
   c. Working test equipment
   d. Two knowledgeable testers and an ITS Rep will meet you at the location

NOTE: If all the above-mentioned items are not completed, you are not ready to test!
UCB ITS Telecom
CAD Standards Guideline

For

Documentation and Construction Projects

Revision – May 14, 2010
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1. INTRODUCTION

This document was produced by the University of Colorado at Boulder, ITS Telecom CAD Department (UCB ITS Telecom CAD Dept.) in April of 2004 and has been revised in May of 2010.

The purpose of this document is to serve as a tight specification for producing and delivering CAD drawings for facility documentation projects and construction projects. The guidelines are intended to ensure the successful use and control of CAD systems and data throughout the UCB ITS Telecom CAD Dept.

Before a project can be closed out and final payment from the UCB ITS Telecom Dept. rendered, all specified materials must be submitted to the appropriate UCB ITS Telecom CAD Dept. project manager or representative in accordance with production standards and special instructions described throughout this document.

A signed copy of the CAD Quality Assurance Checklist found in section 2.B.7 of this document must also be submitted with CAD drawings being delivered during the closeout phase of projects. When a CAD Quality Assurance Checklist has been signed and submitted, the vendor (architect, engineer, contractor, etc.) is assuring that all materials adhere to the standards and guidelines set forth in this document.

The layering standard outlined herein is a slightly modified version of the 1997 American Institute of Architects CAD Layer Guidelines. However, please note that the UCB ITS Telecom CAD Dept. follows its own guidelines for naming and organizing CAD files, instead of following the 1997 AIA recommendations in these areas.

The UCB ITS Telecom Division Standards mentioned in this document refer to the Telecommunication Project Standards found at http://www.colorado.edu/facilitiesmanagement/pdc/construction/standards/index.html.

Please direct any questions or comments about this document to the UCB ITS Telecom CAD Dept. client representative at the address below.

University of Colorado at Boulder
ITS Telecom, CAD Dept.
1045 18th St., 313 UCB
Boulder, CO 80309

Attn:
ITS Telecom – CAD Department
Kevin Gzym, CAD Coordinator
Telephone: 303-492-3855
E-mail: Kevin.Gzym@colorado.edu
2. CAD DRAWING PRODUCTION

A. FILE FORMAT AND SETUP

1. FILES PROVIDED BY UCB ITS TELECOM CAD DEPT.
   a) The UCB ITS Telecom CAD Dept. shall provide consultants with a CD containing all necessary AutoCAD blocks, LISP files, Script Files, base drawings, building numbers and codes, etc. at the beginning of each project.

2. ELECTRONIC FILE FORMAT
   a) Facility documentation drawings and construction project drawings must be submitted to the UCB ITS Telecom CAD Dept. in full compliance with AutoCAD software (file extension = .DWG). The following AutoCAD file formats are acceptable:
      (1) AutoCAD 2010* – DWG format only

*Due to AutoCAD issues the UCB ITS CAD Dept. must save drawings to version 2010 and previous versions will not coincide with information provided by ITS.

3. SCALE AND UNITS
   a) All CAD drawing models should be drafted to scale at full scale.
   b) Imperial (Architectural in AutoCAD) units shall be the standard system of measurement.
   c) The base unit shall be inches.

4. TOLERANCES
   a) For Facility Documentation Drawings
      (1) Typically it is required that exterior building dimensions recorded within CAD drawings must reconcile to within 1 inch of actual building dimensions as measured in the field, and interior building dimensions must reconcile to within 1/2 inch of actual field dimensions. However, individual project specifications may vary. Please confirm dimension error tolerances for each project with your UCB ITS Telecom CAD Dept. client representative.
   b) For Construction Drawings
      (1) Tolerances for construction drawings are implicit within professional service contracts.

5. TEXT
   a) All non-attributed text on UCB ITS Telecom CAD Dept. CAD drawings shall be created using only the Mtext command.
   b) All text on UCB ITS Telecom CAD Dept. CAD drawings shall use only the ROMANS font supplied with AutoCAD's font library. The CAD files submitted shall be plotable without modification.
   c) Text size must be legible and appropriate to the graphic information presented and the intended plotted scale of the drawing (See Appendix 3.A. Figure 1, Dimscale Chart for UCB ITS Telecom CAD Dept.). Text must be in all upper case letters throughout a
drawing.
d) Text usually should not touch other graphic objects, and must be placed with enough space around it to be legible when the drawing is plotted and reproduced.
e) Text may be placed at an angle. It must be readable from the bottom or right edges of the plotted sheet. Generally text should be placed at an angle of 0° or 90°. Text may be placed along (above or below) another element at an angle other than 0° or 90°.
f) Dimensions, labels, notes and drawing titles, when requested as part of the project, shall match existing height on printed drawings.

6. BLOCKS

a) The UCB ITS Telecom CAD Dept. is currently requiring the use of block definitions provided by this department (See Section 2.A.). However, when additional blocks must be created, the UCB ITS Telecom CAD Dept. requires that the following general rules be employed:

(1) All entities within a block must be created on layer 0

7. TITLE BLOCKS

a) Each CAD file submitted to the UCB ITS Telecom CAD Dept. should have only one title block. The title block should be placed in paper space, with its insertion point inserted at a coordinate location of (0,0,0), and at a scale of 1. The cut size of the paper should be 24"x36". Depending on the purpose of the drawing, facility documentation or construction, the drawing's title block should contain certain essential information that the UCB ITS Telecom CAD Dept. needs, to store and retrieve each drawing in its library.

(1) Title Blocks for Facility Documentation Drawings

(a) A generic UCB ITS Telecom CAD Dept. title block template is available for use.

(2) Title Blocks for Construction Drawings

(a) Consulting architects and engineers may use their own title blocks. At minimum, these title blocks should contain all of the information listed below.

(3) Project Information:

(a) Firm Name - representing the drawing author
(b) Project Name - as specified by the UCB ITS Telecom CAD Dept.
(c) Building Number - as specified by the UCB ITS Telecom CAD Dept.
(d) Building Name - specify only if the project name does not include this information already, and the project is building specific
(e) Project Number - assigned by the UCB ITS Telecom CAD Dept

(4) Drawing Information:

(a) Drawing Title - indicating the drawing content, e.g. floor plan, section, detail, etc.
(b) Drawing Number
(c) Date of Drawing - original drawing date including significant revision dates
(d) Drawing Scale - representing the intended plot scale of the drawing with title block
8. MODEL SPACE AND PAPER SPACE

a) The UCB ITS Telecom CAD Dept. requires that each CAD file submitted as a project deliverable contain only one title block in paper space which references the building model contained in model space. Additional models related to the same building are allowed and shall be shown through the use of multiple viewports in paperspace.

b) In addition:

   (1) Label scaled details with the appropriate scale on the detail title in model space.
   (2) Show detail through viewport zoomed to the appropriate scale in paper space.
   (3) Do not place or draw model-related blocks, tags and objects in paper space.
   (4) Draw all model space objects at full scale, and to scale.

9. EXTERNAL REFERENCE FILES (XREFS)

a) The UCB ITS Telecom CAD Dept. will not accept the submission of any CAD drawing deliverable which contains references to external source drawing files created outside of the UCB ITS Telecom CAD Dept. All externally referenced data sources that were used during the CAD drawing production phase, unless created by the UCB ITS Telecom CAD Dept., should be inserted and retained as a block within a single drawing file, including the title block, upon project completion and prior to drawing delivery to the UCB ITS Telecom CAD Dept. External references shall not be “bound” to drawings. The resulting self-contained drawing file is an acceptable deliverable to the UCB ITS Telecom CAD Dept.

10. DRAWING COMPOSITION

a) All AutoCAD drawings shall be purged of empty, unused, or non-essential drawing data prior to submittal to The UCB ITS Telecom CAD Dept. This includes all unused layers, linetypes, blocks, fonts and entities.

b) AutoCAD drawings shall not contain multiple overlaid lines or lines with multiple segments unless the overlaid lines or adjacent line segments are assigned to different layers.

c) Blocks should not be exploded.

d) Drawings should be left in paperspace and zoomed extents.

e) The menu should be set to ACAD.

11. ANNOTATION

a) Annotation can be placed in either model space or paper space. Annotations related to model data, such as dimensions, notes, drawing titles, legends and callouts must be included in the model space where they are easier to coordinate and revise.

b) Other annotations, such as sheet-specific notes, are more convenient to work with when placed on the drawing sheet in paper space.

c) Leaders shall extend from the vertical midpoint of the top line of the annotation and point to the object being described. Leaders can extend from the right or left side of the annotation. Leaders shall be placed on the same layer as the annotation for the object.

12. DIMENSIONS
a) All dimensions shown in the project submittals shall be fully associative. Dimension definition points should be located with an appropriate Object Snap (End Point, Mid Point, etc.) or otherwise located precisely on the project geometry. Manual input of dimension text or otherwise over-riding the actual dimensions is NOT acceptable in submittals to the UCB ITS Telecom CAD Dept.

13. LAYERING

a) The UCB ITS Telecom CAD Dept. has adopted most of the layer name and use rules recommended by the CAD Layer Guidelines published in 1997 by the American Institute of Architects (AIA CAD Layer Guidelines NCS Version 2). AIA recommendations, which have been adopted by the UCB ITS Telecom CAD Dept. are included in this section. Where noted, the UCB ITS Telecom CAD Dept. has supplemented the AIA guidelines with its own rules and standards, as necessary. A copy of the current National CAD Standards may be obtained from http://www.buildingsmartalliance.org/ncs/.

(1) STANDARD LAYER LISTING

This section contains a partial list of AIA recommended layers to be used when producing facility documentation drawings, construction drawings, fiber schematics and Outside Plant (OSP) drawings for the UCB ITS Telecom CAD Dept.

(2) CORE LAYER ATTRIBUTE – TELECOM LAYERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Sheets*</th>
<th>Description</th>
<th>Color</th>
<th>Linetype</th>
</tr>
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<tbody>
<tr>
<td>T-ANNO-CATV</td>
<td>All</td>
<td>CATV Text</td>
<td>74</td>
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</tr>
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<td>T-ANNO-COND</td>
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<td>Continuous</td>
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<td>T-ANNO-COPR</td>
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<td>Cable Copper Text</td>
<td>142</td>
<td>Continuous</td>
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<tr>
<td>T-ANNO-DEMO</td>
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<td>Demo Text</td>
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<td>Dimensions</td>
<td>3-green</td>
<td>Continuous</td>
</tr>
<tr>
<td>T-ANNO-DIST</td>
<td>JK</td>
<td>Distance Arcs Text</td>
<td>12</td>
<td>Continuous</td>
</tr>
<tr>
<td>T-ANNO-ELEC</td>
<td>TS</td>
<td>Electrical Text</td>
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<tr>
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<td>Continuous</td>
</tr>
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<td>Cable Fiber Text</td>
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</tr>
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<tr>
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<tr>
<td>T-ANNO-INDT</td>
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<td>Innerduct Text</td>
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</tr>
<tr>
<td>T-ANNO-LEGN</td>
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<td>Legends and Schedules</td>
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</tr>
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<td>T-ANNO-NOTE</td>
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<td>Job Notes</td>
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<td>T-ANNO-NPLT</td>
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<td>No-Plot Text, Viewports</td>
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<td>Text for Raster Images</td>
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<td>T-ANNO-SHAD</td>
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<td>T-ANNO-SYMB-TERM</td>
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<td>Terminal Symbols</td>
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<td>T-ANNO-TTLB</td>
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<td>Buildings Demolished, OSP</td>
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<td>T-BLDG-TUNL</td>
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<td>Bldg Elements, Tunnels–Details</td>
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<td>Phantom</td>
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<tr>
<td>T-CABL-CATV</td>
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<td>Cable TV</td>
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<td>Abbreviation</td>
<td>Type</td>
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<td>Color</td>
<td>Line Style</td>
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<td>--------</td>
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<td>------------</td>
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<tr>
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<td>Innerduct</td>
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<td>Conduit, D-rings</td>
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<td>Distance Arcs from Term</td>
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<td>Dot</td>
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<td>T-ELEC</td>
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<td>T-ELEC-GEN</td>
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<td>Equip, CATV</td>
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<td>Campus Grid</td>
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<td>T-JACK</td>
<td>JK, OSP</td>
<td>Data/Telephone Jacks</td>
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<tr>
<td>T-JACK-FIBR</td>
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<td>Fiber Jacks</td>
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<td>T-JACK-?????</td>
<td>JK</td>
<td>Alt-Owner Jacks (replace ???? 3 green</td>
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<tr>
<td></td>
<td></td>
<td>with Owner Abbreviation)**</td>
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<td></td>
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<tr>
<td>T-MISC</td>
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<td>Equipment Rack</td>
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<td>Continuous</td>
</tr>
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<td>T-RACK-LADR</td>
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<td>Ladder Rack</td>
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<tr>
<td>T-RSTR</td>
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<td>Raster Images</td>
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<td>Continuous</td>
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<tr>
<td>T-SCHM-BLDG</td>
<td>SCHM</td>
<td>Building Outline 4-cyan</td>
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<td></td>
</tr>
<tr>
<td>T-SCHM-FIBR</td>
<td>SCHM</td>
<td>Fiber</td>
<td>7-white</td>
<td>Continuous</td>
</tr>
<tr>
<td>T-SCHM-FIBR-EQPM</td>
<td>SCHM</td>
<td>Fiber Equipment</td>
<td>2-yellow</td>
<td>Continuous</td>
</tr>
<tr>
<td>T-SCHM-FIBR-FUTR</td>
<td>SCHM</td>
<td>Fiber - Future</td>
<td>7-white</td>
<td>Dashed</td>
</tr>
<tr>
<td>T-SCHM-FIBR-?????</td>
<td>SCHM</td>
<td>Fiber - Alt-Owner (replace ???? with Owner Abbreviation)**</td>
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<td></td>
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<tr>
<td>T-SHAD-1</td>
<td>JK</td>
<td>Shade (grayed back) layer</td>
<td>155</td>
<td>Phantom</td>
</tr>
<tr>
<td>T-TEMP</td>
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<td>Temporary Information</td>
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<tr>
<td>T-WALL-TEMP</td>
<td>All</td>
<td>Walls, partitions not FACMAN</td>
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</tr>
<tr>
<td>T-00-000</td>
<td>All</td>
<td>Project Layer***</td>
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</tr>
<tr>
<td>T-00-000-ALT</td>
<td>All</td>
<td>Project Layer – Alternate***</td>
<td>150</td>
<td>Hidden</td>
</tr>
<tr>
<td>T-00-000-TEXT</td>
<td>All</td>
<td>Project Layer - Text ***</td>
<td>152</td>
<td>Continuous</td>
</tr>
</tbody>
</table>

*Sheet Abbreviations
- All – All Drawing Types
- As Req. – As required
- DET – Detail Sheet
- JK – Jack Map
- MH – Manhole Drawing
- OSP – Outside Plant Drawing
- SCHM – Schematics (Fiber)
- TS – Terminal Sheets

** Owner Abbreviations for Alt-Owner Jacks/Fiber:
- ANET – Alliance Network
- CARD – Card Readers
- CATV – Cable TV
- FACM – Facilities Management
*** Project layers are intended for revision clouds and notes pertaining to a particular project, designated by the project number in the layer name (Replace “0’s” with project number). Drawing entities to be demolished may be placed on a project layer in lieu of a “demo” layer. New work shall be placed on layers with existing entities according to the entities being added. All new information, including line-work, shall be enclosed in a revision cloud drawn on the project layer. The project number shall be placed within the revision cloud on the project layer. All entities in a project layer will be deleted after the completion of a project.

(3) **Layer Name Formatting**

As recommended by the 1997 AIA CAD Layer Guidelines, layer names may be as short as six characters (discipline code + major group) or as long as sixteen characters (discipline code + major group + minor group + status). Here are four examples of acceptable formula variations:

- # 1 T-COND = discipline code + major group
- # 2 T-CABL-FIBR = discipline code + major group + minor group
- # 3 T-SCHM-FUTR = discipline code + major group + status code
- # 4 T-SCHM-FIBR-FUTR = discipline code + major group + minor group + status

(4) **Attributes**

(a) **Linetypes**
The default linetype of each layer is typically CONTINUOUS unless otherwise specified. Drawing entities shall assume the linetype property of the layer on which they reside. This means that the linetype of individual entities shall be assigned ‘by layer’ as opposed to ‘by entity.’

(b) **Colors**
The UCB ITS Telecom CAD Dept. recommends the use of specific colors for core layers and annotation layers (see the previous section regarding the definition of core layers). Drawing entities shall assume the color property of the layer on which they reside. This means that the color of individual entities shall be assigned ‘by layer’ as opposed to ‘by entity.’

(c) **Pen Weight**
The following chart shows pen weight assignments, which should maximize the printed clarity of drawings conforming to the color assignments of the UCB ITS Telecom CAD Dept.‘s core layers.

<table>
<thead>
<tr>
<th>Pen #</th>
<th>Color</th>
<th>Weight</th>
<th>Core drawing elements (including, but not limited to):</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 red</td>
<td></td>
<td>.010 in</td>
<td>Emergency Phone</td>
</tr>
<tr>
<td>2 yellow</td>
<td></td>
<td>.010 in</td>
<td>Racks, Cable Management</td>
</tr>
<tr>
<td>3 green</td>
<td></td>
<td>.010 in</td>
<td>Jacks (alternate ownership), Notes, Dimensions</td>
</tr>
<tr>
<td>4 cyan</td>
<td></td>
<td>.010 in</td>
<td>Copper Cable/Equip, Room Numbers, Building,</td>
</tr>
<tr>
<td>5 blue</td>
<td></td>
<td>.010 in</td>
<td>Innerduct</td>
</tr>
<tr>
<td>6 magenta</td>
<td></td>
<td>.010 in</td>
<td>Fiber (OSP, Terminal Sheets)</td>
</tr>
<tr>
<td>7 white</td>
<td></td>
<td>.010 in</td>
<td>Title Block, Fiber Strands (fiber schematics)</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>.010 in</td>
<td>Building Demo</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>.010 in</td>
<td>Conduit</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>.010 in</td>
<td>Cable TV</td>
</tr>
<tr>
<td>150</td>
<td></td>
<td>.020 in</td>
<td>Project</td>
</tr>
<tr>
<td>165</td>
<td></td>
<td>.010 in</td>
<td>Temp</td>
</tr>
</tbody>
</table>
14. FILL AND HATCH PATTERNS

a) Limit excessive use of hatch patterns to avoid unnecessarily large files. All consultants are responsible for keeping files sizes within reasonable limits. A solid hatch shall be created by only using AutoCAD “SOLID” hatch pattern. Using dense hatch patterns to create solid fill shall not be permitted in the drawing set.

15. AUTOCAD DRAWING SUPPORT FILES

a) Drawings created using non-standard AutoCAD fonts, linetypes and hatch patterns can result in content discrepancies in the delivered drawing set. To ensure the integrity of the drawing set, and minimize potential problems:

(1) Only native AutoCAD fonts, linetypes and hatch patterns shall be used. These are standard support features installed as part of a standard AutoCAD installation.
(2) Postscript fonts shall not be used.

16. FILE NAME CONVENTIONS

a) As explained in the section entitled Model Space and Paper Space, the UCB ITS Telecom CAD Dept. requires that each CAD file submitted as a project deliverable, contain only one major drawing model with one title block (i.e. one building plan, etc.). This policy allows each CAD file produced for either a facility documentation project or a construction project to be named according to the conventions outlined below

(1) Naming Facility Documentation Drawings (primary method):

(a) CAD files produced by Preferred CAD Vendors, which typically contain drawings of existing facility conditions should be named according to the following examples:

EXAMPLES:
WLRD-327-1f.dwg = building + first floor 1f
TCOM-210-1b.dwg = building + basement 1b
Fib144.dwg = fiber schematic for cable 144
Fib144-2.dwg = fiber schematic for cable 144, sheet 2
stad-378-tr-1b23.dwg = terminal sheet for Stadium, Room 1B23

(2) Building ID Code:
(a) The standard UCB ITS Telecom CAD Dept. building identification code assigned by UCB Facilities Management is normally a four (4) alpha character code. The standard building identification codes that pertain to your project can be found on the CD mentioned in section 2.A.1.a.

(3) Floor ID Code:
(a) The standard floor identification code follows a two digit numbering system. Floors above or at grade are numbered sequentially in ascending order, starting with 1f, 2f, 3f, etc. Floors that are below grade are numbered in descending order, starting with 1b (basement), 2b, (sub-basement), 3b, etc.

17. STANDARD SHEET SIZES AND FORMATS
University of Colorado @ Boulder
ITS Telecom CAD Standards

Revision – 05-14-10

a) All sheet sizes are to be limited to three standard formats. Required sheet size is specific to each project and is under the discretion of the University. They are as follows:
   (1) A Sized Plot 8 1/2” x 11”
   (2) B Sized Plot 11” x 17”
   (3) D Sized Plot 24” x 36” (preferred format)

18. RASTER GRAPHICS

a) Raster files shall not be used to represent the project geometry, e.g. building plans or other drawings shall not be scanned and inserted as raster files. Raster files may be used for the incorporation of existing condition photos or similar applications. Raster files included in a drawing shall be placed on layer T-RSTR.

19. CAD FILE TRANSMITTAL

a) The content of electronic drawings must match the delivered original hard copy set as closely as possible, if not exactly. To ensure the integrity of the electronic drawing set upon delivery to The UCB ITS Telecom CAD Dept.:

   (1) Ensure the drawings adhere to the guidelines presented in this document.
   (2) Include a transmittal sheet (electronic and hard copy) with all submittals indicating the UCB ITS Telecom CAD Dept. project number, project name and complete listing of all materials submitted, including filenames and sheet numbers for each item included in the submittal. This ensures the completeness of the drawing set and assists in archival procedures.
   (3) Include hard copy prints of all drawing submittals per UCB ITS Telecom Division Standards (http://www.colorado.edu/facilitiesmanagement/pdc/construction/standards/index.html)
   (4) Submit AutoCAD .PC2 or .PCP plot configuration files whenever necessary.
   (5) Submit AutoCAD files (See section 2.A.2. a.) and other electronic format files on CD-ROM formatted for Windows. All files are to be copied directly to CD-ROM. No compression or archive utilities are allowed.
   (6) Electronic data deliverables are required with all major submittals.

20. CD-ROM LABELING

a) All CDs are to be labeled as follows:
   (1) CAMPUS: Campus for which the project is intended. Specify satellite location if applicable.
   (2) DATE: The date when the submittal was delivered to the campus for final acceptance.
   (3) PROJECT: Title of the project.
   (4) SUBMITTAL: Project submittal phase (i.e. 50% schematic etc.)
   (5) BLDG NUMBERS: Building number identified by the campus specific to the project.
   (6) AUTOCAD VERSION: AutoCAD version.
   (7) WINDOWS VERSION: Windows version.
   (8) COMPANY: Name of consultant to the campus.
   (9) PHONE NUMBER: Phone number of consultant.
   (10)CD-ROM: CR-ROM Number. Label as CD-ROM x of y. When only a single CD is used for the submittal, label as CD-ROM 1 of 1
   (11)FILES: List of drawings included on CD-ROM.
   (12)Individual specification sections are not to be listed on the CD-ROM label. Limit file listing on text files to either “SPECIFICATIONS” of “FILE DESCRIPTIONS”.

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N:\Network Services\ITS CAD\Standards\UCB TCOM CAD Standards - rev 05-14-10.doc
Last printed 5/24/2010 10:48:00 AM
21. DOCUMENTATION

a) The delivered CAD drawing files must be accompanied by the documentation described below. This information must cover all CAD files delivered to the UCB ITS Telecom CAD Dept.

(1) A list of any extended discipline codes, non-standard drawing type codes, and user defined codes that are used in the CAD file names.

(2) A list of approved exceptions to the standard layer structure (a single exception list is acceptable if all files conform to the list.

(3) A list of any deviations from the standards, with reference to the written approval obtained for those deviations that required prior approval.

(4) A description of any third party products that have been used with the drawings and reference to written approval for their use is required. This is necessary if the CAD application software:

   (a) Affects the UCB ITS Telecom CAD Dept.’s ability to review or edit the drawings.
   (b) Requires the UCB ITS Telecom CAD Dept. to own a license to the software to work with the CAD files without violating the software’s copyrights.

22. SOFTWARE AND SOFTWARE LICENSES

a) The UCB ITS Telecom CAD Dept. requires that the delivered CAD files be usable without any additional software licenses or installation.

B. ITS CAD DEPARTMENT PROCEDURES

1. REQUESTING CAD DATA FROM THE UCB ITS TELECOM CAD DEPT.

a) Consultants may request copies of existing CAD data for University facilities. CAD Data is provided for the convenience of the recipient only. This data has been gathered from a variety of sources and it may or may not conform to University of Colorado at Boulder standards. The data may be incomplete, or may not accurately reflect current facility conditions. The UCB ITS Telecom CAD Dept. makes no representation as to the data’s completeness or accuracy. Consultants should also acknowledge that CAD data appears to be extremely accurate because it has been generated with a computer, and that the accurate appearance of drawings does not guarantee that they truly represent existing conditions. CAD data submitted by consultants to the UCB ITS Telecom CAD Dept. must be accurate and must conform to the current CAD standards, even if reference data provided by the UCB ITS Telecom CAD Dept. was inaccurate or did not conform to the standards.

b) Acquisition of Electronic (Outside Plant (OSP) Map) Data: All rights reserved. Map data provided by Facilities Management CAD Office is intended for the sole use of the contractor to satisfy obligations to the University of Colorado construction contracts. The map information may include copyright Electronic Spatial Data from Boulder County and/or the City of Boulder and may not be copied, duplicated, or redistributed in any way, in whole or in part, without expressed written consent by Boulder County and/or City of Boulder. Agreement of "Electronic Data Limitations and Conditions of Use" must be entered into by and between the University of Colorado and consultant prior to release of above mentioned electronic data.
2. SUBMITTAL REQUIREMENTS

a) All AutoCAD drawings forwarded to the UCB ITS Telecom CAD Dept. shall be submitted in a timely fashion, coinciding with the needs of the project and The UCB ITS Telecom CAD Dept. staff. The delivery of AutoCAD documentation during various project stages shall be timed appropriately to ensure that the UCB ITS Telecom CAD Dept. ultimately receives the most accurate information available. The receipt of electronic AutoCAD drawings alone does not alleviate the responsibility of the Consultant for providing hard copy documentation to the UCB ITS Telecom CAD Dept.

b) The following documentation shall be delivered to the UCB ITS Telecom CAD Dept. at the following project milestones:

(1) Construction:
   (a) The UCB ITS Telecom CAD Dept. requires a complete set of Construction Documents in AutoCAD and hard copy format when the project enters the construction phase. The number of hard copy sets required will vary depending on the project. Contact UCB ITS Telecom CAD Dept. client representative for quantity of hard copy sets required for the project.

(2) Completion:
   (a) When the project has been completed, the Consultant shall submit a complete set of As-built documents in AutoCAD electronic and hardcopy formats to the UCB ITS Telecom CAD Dept.

   (b) Refer to the construction specifications for further detail in regards to “Construction Drawings As-built Requirements”. http://www.colorado.edu/facilitiesmanagement/pdc/construction/standards/index.html.

3. SUBMITTAL SCHEDULE

a) The final submittal of as-built CAD data should be made after project construction is complete and facilities have been occupied. In addition, the UCB ITS Telecom CAD Dept. may require sample submittals at key milestones in the development of the CAD drawings, specifications and data in accordance with the contract and/or UCB ITS Telecom Division Standards. Sample submittals are not intended to be a burden on the consultant, and typically will involve a very limited number of drawings. Digital media submittals, as a minimum, shall be provided at the first and final submittal milestones. Providing digital media at the first submittal milestone will allow the UCB ITS Telecom CAD Dept. to verify that the data structures being used by the consultant conform to the CAD data standards and are readily usable on the UCB ITS Telecom CAD Dept. CAD systems.

4. VALIDATION OF DELIVERED MATERIALS

a) The UCB ITS Telecom CAD Dept. will validate the CAD data and other materials submitted by consultants. If submittals do not conform to the UCB ITS Telecom CAD Standards Guidelines, the UCB ITS Telecom CAD Dept. may return the materials to the consultant. The consultant is responsible for revising the materials to make them conform to the UCB ITS Telecom CAD Standards Guidelines.

b) The UCB ITS Telecom CAD Dept. recommends the use of the eTransmit command in
AutoCAD to create a .zip file containing all drawings, associated x-refs, pen settings files, etc. to be included in the submittal to the UCB ITS Telecom CAD Dept.

5. COMMUNICATION ABOUT THE CAD STANDARDS

a) These CAD Standards will be most effective for the UCB ITS Telecom CAD Dept. and most usable for consultants if there is communication between consultants and the University Owner's Representative. Consultants should ask questions about the CAD data standards before beginning work. Direct questions to the UCB ITS Telecom CAD Dept. Concerns regarding the impact of the CAD standards on a particular project must be discussed with the Owner's Representative. Consultant’s questions are valuable because they help the UCB ITS Telecom CAD Dept. understand the real-world conditions of each project's design and construction process. Questions will raise issues that will result in better CAD standards.

6. SUGGESTIONS FOR THE STANDARDS

a) The content of the manual is intended to be neither static nor all-inclusive and thus will be updated and enhanced as appropriate. Suggestions for improvements are encouraged so that subsequent updates reflect the needs of the University. Submit suggestions, as well as any pertinent new information, which would enhance these standards, to the UCB ITS Telecom CAD Dept. client representative.
7. CAD QUALITY ASSURANCE CHECKLIST

CAD drawings delivered upon closeout of project must be accompanied by submission of the following checklist. When a checklist has been signed and submitted, the vendor (architect, engineer, contractor, etc.) is assuring that all materials adhere to the standards and guidelines set forth in this document.

CHECKLIST –

File Format and Setup
- Electronic File Format
- Scale and Units
- Tolerances
- Text
- Blocks
- Title blocks
- Model Space and Paper Space
- External Reference Files (XREFs)

Drawing Composition
- Annotation
- Dimensions
- Layering
- Fill and Hatch Patterns
- AutoCAD Drawing Support Files
- File Name Conventions
- Standard Sheet Sizes and Formats
- Raster Graphics
- Cad File Transmittal
- CD Rom Labeling
- Documentation
- Software and Software Licenses

Name of Accountable Vendor Representative (please print) _______________________________________

Signature of Accountable Vendor Representative______________________________________________

Phone Number _________________________________________________________________

E-mail _____________________________________________________________________________

Date _______________________________________________________________________________
3. APPENDIX

A. Figure 1 - Dimscale Chart for UCB ITS Telecom CAD Dept.

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<th>DRAWING TYPE</th>
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Plotted Text height (inches) x Dimscale = Actual (CAD) text height
Dimscale is the number of drawing scale units in a foot
B. Figure 2 – New Jacks - Phase 1

1. Design, Prints and T5 Jack Form
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C. Figure 3 - New Jacks – Phase 2

1. Final Jack Testing - Final Jack Prints and T5 Jack Form
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Note: Added jacks are to be placed at the end of the T5, do not fill in open gaps.
D. Figure 4 - New Jacks – Phase 3

1. Final CAD As-Built.
E. Figure 5 - Sample Terminal Room Footprint
F. Figure 6 - Sample Cable Layout
G. Figure 7 - Sample Rack Detail
H. Figure 8 - Sample Wall Detail
I. Figure 9 - Sample Fiber Sheet
J. Figure 10 - Sample Outside Plant Drawing
Addendum to UCB ITS Division 27 standards on August 12, 2010.

27 01 00 1.04

E. The Contractor Consultant shall submit the proposed outlet numbers, using the T-5 template provided by ITS, for review and approval prior to construction. The T-5 shall be submitted in two phases at the CD level, one as a “Draft” T-5 at which time UCB ITS will return corrections to be made and within one week the “Final” shall be submitted with all the corrections made to the T-5 by the Consultant to UCB ITS (some projects have the Contractors building and submitting the T-5 because of older specifications).

F. c. Preliminary as-built station cabling drawings, with all outlet numbers identified on the floor-plans and a pre-numbered T-5 jack numbering template, shall be provided to UCB ITS at CD phase within two (2) weeks of award on big projects (within two days on small projects, by the Contractor instead of the Consultant for all submittals) and are expected to not change or adjust after the submittal unless errors are found which are corrected immediately after approval from UCB ITS. Additional T-5 lists shall be submitted for all deletions and additional outlets by the Consultant with an updated floor-plan more than five (5) additions through the project as well as a list of five (5) or more deletions on a standalone list not to include the original list. The submittal shall also include the contractor’s construction timeline with all milestones included.

F. d. At one (1) week prior to occupancy, or as agreed on per the project schedule with UCB ITS, the contractor shall submit an updated hard copy of the as-built drawings and an updated electronic and hard copy of the T-5 jack numbering template of which the installed work was based with all the changes and device locations. All changes must have the approved signature of the UCB ITS project manager. Notations and changes shall be done in a neat and legible manner by marking the original drawings with red pencil to indicate additions and green pencil to indicate deletions. Within four (4) weeks of the testing the “As-built” T-5 shall be submitted (electronic) to UCB ITS and the Consultants by the Contractor with all testing corrections.

F. f. A hard copy and electronic copy of the as-built files shall be submitted to UCB ITS from the contractor and communication consultant within four (4) weeks of completion of the project. All re-submittals shall be submitted within two (2) weeks to UCB ITS. These as-built documents apply to all projects unless written approval from UCB ITS. This submittal shall not be held up for delivery to UCB ITS for any reason. The Consultant has the final responsibility to get As-built files to UCB ITS within five (5) weeks of completion of the project.

27 17 00 1.04

C. The Contractor Consultant shall submit the proposed outlet numbers, using the T-5 template provided by ITS, for review and approval prior to construction.

27 11 00 2.04

2.04 PATCH CORDS
A. Copper Category 5e, various lengths as required for project:
   a. Colored Blue for Voice in TR and ER (NO BOOT)
   b. Colored Black for Data in TR and ER (NO BOOT)
   c. Desktop Mounting Cord Colored Black for Data at Outlet Location (NO BOOT)
   d. Special Circuit Cord Colored Yellow for Circuits other than Voice or Data in TR and ER (NO BOOT)
   e. For Housing Only: Video Cameras, Fire, and Health & Safety Colored Red in TR and ER
   f. For Housing Only: Colored Gray for Data in TR and ER
   g. For Housing Only: Desktop Mounting Cord Colored Gray for Data at Outlet Location
   h. For Housing Only: Colored Yellow for Wireless Access Points in TR and ER
   i. For Housing Only: Colored Purple for Ccure and card readers in TR and ER
   j. For Housing Only: Colored Orange for Andover and CBORD (dining POS) in TR and ER

B. Copper Category 6, various lengths as required for project:
   a. Colored Blue for Voice in TR and ER
   b. Colored Black for Data in TR and ER
   c. Desktop Mounting Cord Colored Black for Data at Outlet Location
   d. Special Circuit Cord Colored Yellow for Circuits other than Voice or Data in TR and ER
   e. For Housing Only: Colored Yellow for Wireless Access Points in TR and ER
   f. For Housing Only: Video Cameras, Fire, and Health & Safety Colored Red in TR and ER
1. GENERAL

A. RELATED DOCUMENTS

1. The General Provisions of the Contract including General and Supplementary Conditions, Specification Sections and Contract Documents of Division 1, and other related sections apply to work in this section. Consult them for further instructions and be governed by their requirements.

B. WORK INCLUDED

1. WORK INCLUDED IN THIS SECTION

a) Computer Aided Drawing standards for construction (CAD)

b) All required documentation for CAD office

c) Required submittal media and format

2. SECTION INTENT

a) The University of Colorado at Boulder is actively pursuing a program of computerized construction related documents and Computer Integrated Facilities Management (CIFM). In general terms, this section describes the requirements for CAD related drawings, the required accompanying documentation, and the form and format of the electronic data.

The intent of these standards is two-fold; first, to not jeopardize the efficiency of the consultant’s internal drawing development methods by imposing overly ambitious CAD standards; and second, to provide a set of documents that are consistent with the needs of the University of Colorado for both Facilities Management and future construction.

2. CAD DRAWING PRODUCTION

A. FILE FORMAT AND SETUP

1. FILES PROVIDED BY CAD DEPT.

a) The CAD Office shall provide consultants with a CD or .zip file containing all necessary base drawings, building numbers and codes, etc. at the beginning of each project upon request.
2. ELECTRONIC FILE FORMAT

a) Facility documentation drawings and construction project drawings must be submitted to the CAD Office in full compliance with AutoCAD software (file extension = .DWG).

b) Projects designed as a Revit model must be submitted to the CAD Office in the “.rvt” format.

c) The University of Colorado shall not accept any drawings in the Drawing Interchange Format (DXF) or any other format than .DWG. If any drawing translators are used prior to submittal, the results of such translations shall be 100% complete. It is the responsibility of the Consultant to cross-check translated drawings for errors and omissions.

3. TEXT

a) Text size must be legible and appropriate to the graphic information presented and the intended plotted scale of the drawing. Text must be in all upper case letters throughout a drawing.

b) Text usually should not touch other graphic objects, and must be placed with enough space around it to be legible when the drawing is plotted and reproduced.

4. TITLE BLOCKS

a) The title block should be placed in paper space, with its insertion point inserted at a coordinate location of (0,0,0), and at a scale of 1:1. Depending on the purpose of the drawing, facility documentation or construction, the drawing’s title block should contain certain essential information that the CAD Office needs, to store and retrieve each drawing in its library.

1) Project Information:

   (a) **Project Number** - assigned by the UCB Facilities Management Dept.
   (b) Firm Name - representing the drawing author
   (c) Building Name - specify only if the project name does not include this information already, and the project is building specific

2) Drawing Information:

   (a) • Drawing Title - indicating the drawing content, e.g. floor plan, section, detail, etc.
   (b) • UCB Project Number – all sheets
   (c) • Drawing Number
   (d) • Date of Drawing - original drawing date including significant revision
dates
(e) • Drawing Scale - representing the intended plot scale of the drawing with title block
(f) • North Arrow
(g) • Electronic File Name

5. MODEL SPACE AND PAPER SPACE

a) The CAD Office requires that each CAD file submitted as a project deliverable contain only one title block, per layout, in paper space which references the building model contained in model space. Additional models related to the same building are allowed and shall be shown through the use of multiple viewports in paper space.

b) In addition:

1) Draw all model space objects at full scale, and to scale.
2) Label scaled details with the appropriate scale on the detail title in model space.
3) Show detail through viewport zoomed to the appropriate scale in paper space.
4) Do not place or draw model-related blocks, tags and objects in paper space.

6. EXTERNAL REFERENCE FILES (XREFs)

a) Drawings containing x-refs shall be prepared for submittal to the CAD Office by using the e-transmit command within AutoCAD. See 2.A.11.a.5.

7. DIMENSIONS

a) All dimensions shown in the project submittals shall be fully associative. Dimension definition points should be located with an appropriate Object Snap (End Point, Mid Point, etc.) or otherwise located precisely on the project geometry. Manual input of dimension text or otherwise over-riding the actual dimensions is NOT acceptable in submittals to the CAD Dept.

8. FILL AND HATCH PATTERNS

a) Limit excessive use of hatch patterns to avoid unnecessarily large files.

9. AUTOCAD DRAWING SUPPORT FILES

a) Drawings created using non-standard AutoCAD fonts, linetypes and hatch patterns can result in content discrepancies in the delivered drawing set. To ensure the integrity of the drawing set, and minimize potential problems:
1) Use the e-transmit command within AutoCAD. See 2.A.11.a.5.
2) Postscript fonts shall not be used.

10. STANDARD SHEET SIZES AND FORMATS

a) All sheet sizes are to be limited to five standard formats. Required sheet size is specific to each project and is under the discretion of the University. They are as follows:
   1) A Sized Plot 8 1/2” x 11”
   2) B Sized Plot 11” x 17”
   3) D Sized Plot 24” x 36” (preferred format)
   4) E1 Sized Plot 30” x 42”
   5) E Sized Plot 36” x 48”

11. CAD FILE TRANSMITTAL

a) The content of electronic drawings must match the delivered original hard copy set. To ensure the integrity of the electronic drawing set upon delivery to The CAD Dept.:
   1) Ensure the drawings adhere to the guidelines presented in this document.
   2) Include a transmittal sheet (electronic and hard copy) with all submittals indicating the CAD Office project number, project name and complete listing of all materials submitted, including filenames and sheet numbers for each item included in the submittal. File names shall contain the sheet number they represent. This ensures the completeness of the drawing set and assists in archival procedures.
   3) Electronic data deliverables (.DWG and PDF format) are required at all submittal stages.
   4) Submit AutoCAD files (See section 2.A.2.a.) and other electronic format files on CD-ROM formatted for Windows.
   5) The CAD Office requires using the e-transmit command within AutoCAD for all drawing transmittals. Individual drawings or multiple drawings may be zipped together with the e-transmit command. Transmittal options within the e-transmit command shall be set to “place all files in one folder” and “include fonts”. X-referenced and CTB files will be included in the e-transmit file.
   6) Include hard copy prints per UCB Facilities Management Division Standards (http://www.colorado.edu/facilitiesmanagement/pdc/cad/index.html)
   7) The Project Manager (PM) shall withhold final payment until all closeout documents have been received from all parties. Refer to http://www.colorado.edu/facilitiesmanagement/pdc/construction/documents/CloseoutProcess10-26-05.pdf for complete information.

12. CD-ROM LABELING
a) All CDs are to be labeled as follows:
1) DATE: The date when the submittal was delivered to the campus for final acceptance.
2) PROJECT: Title of the project and PR #.
3) SUBMITTAL: Project submittal phase (i.e. 50% schematic etc.)
4) BLDG NUMBERS: Building number identified by the campus specific to the project.
5) COMPANY: Name of consultant to the campus.
6) CD-ROM: CR-ROM Number. Label as CD-ROM x of y. When only a single CD is used for the submittal, label as CD-ROM 1 of 1

13. SOFTWARE AND SOFTWARE LICENSES

a) The CAD Office requires that the delivered CAD files be usable without any additional software licenses or installation.

B. FM CAD DEPARTMENT PROCEDURES

1. START-UP INFORMATION

a) Key Plan - Shall be either a building footprint or a site plan with the project area noted. Key plans shown shall be for the purpose of locating sheet specific information within the project area.

b) Current Room Numbers – Only the most current room numbers shall be used on project documentation. These numbers may be obtained from the floor plan drawings maintained by the CAD Office.

1) Room numbers are subject to change after review by the CAD Office New floor plan drawings and modifications to existing floor plan drawings require room number assignments by the Capital Assets and Space Planning (CASP) Department. The CAD Office will obtain new room numbers and forward this information to the consultant for incorporation into the revised floor plans. Subsequent changes to the floor plans will require this process to be repeated.

2. REQUESTING CAD DATA FROM THE CAD DEPT.

a) Consultants may request copies of existing CAD data for University facilities. CAD Data is provided for the convenience of the recipient only. This data has been gathered from a variety of sources and it may or may not conform to University of Colorado at Boulder standards. The data may be incomplete, or may not accurately reflect current facility conditions. The CAD Office makes no representation as to the data’s completeness or accuracy. Consultants should also acknowledge that CAD data appears to be extremely accurate because it has been generated with a computer, and that the accurate appearance of drawings does not guarantee that they truly represent existing conditions. CAD data submitted by
consultants to the CAD Office must be accurate and must conform to the current CAD standards, even if reference data provided by the CAD Office was inaccurate or did not conform to the standards.

b) The FM CAD Office will not research and/or compile the necessary drawings needed for a specific project. It is the responsibility of the project manager or consultant to come in and choose the appropriate information and request copies from the FM CAD Office.

c) Acquisition of Site Map Data: All rights reserved. Map data provided by Facilities Management CAD Office is intended for the sole use of the contractor to satisfy obligations to the University of Colorado construction contracts. The map information may include copyright Electronic Spatial Data from Boulder County and/or the City of Boulder and may not be copied, duplicated, or redistributed in any way, in whole or in part, without expressed written consent by Boulder County and/or City of Boulder. Agreement of "Electronic Data Limitations and Conditions of Use" must be entered into by and between the University of Colorado and consultant prior to release of above mentioned electronic data.

d) The FM CAD Office will not provide CAD files or copies of design documents to sub-consultants or contractors working on the same or another related project. This information is the property of the design firm until the project is complete and record documents are submitted to the FM CAD Office.
3. SUBMITTAL REQUIREMENTS
   a) All submittal documentation forwarded to the CAD Office shall be submitted in a
timely fashion, coinciding with the needs of the project and the CAD Office staff.
The delivery of submittal documentation during various project stages shall be
timed appropriately to ensure that the CAD Office ultimately receives the most
accurate information available.

b) Ensure that the Facilities Management Project Number is located on all
drawing sheets (including the cover sheet) and all other submitted
documentation, i.e. Specifications and Operations and Maintenance
Manuals. The FM project number should be located in the title block of all
drawings, and in the header or footer of Specifications and Operations and
Maintenance Manuals, and any other submitted items.

c) The following documentation shall be delivered to the CAD Office at the
following project milestones:
   1) Review sets (SD, DD, 1-100%):
      (a) The CAD Office requires a complete set of documents as specified in
      the standard CU Architect/Engineer Contract including:
         (1) AutoCAD drawings in electronic format (.DWG and .PDF)
         (2) Building Information Models (BIM) in Revit format (.rvt) (projects
             with a construction budget over $2 million)
         (3) Specifications - submit electronically in PDF format as one
document, OCR searchable, bookmarked according to CSI
             standards

2) Completion of Civil Utilities Installation:
   (a) Site Development Drawings (Survey) shall be set up using CO-HARN
   coordinates and the drawing units set to decimal feet. When required, the
   survey shall be tied to a control network provided by the CAD Office
   (1) The CAD Office requires a complete set of Site Development
   Drawings (Survey) as specified in the standard CU
   Architect/Engineer Contract including:
      a AutoCAD Record Site Development Drawings (Survey) in
         electronic format (.DWG and .PDF and hardcopy
         – 1 set)
      b Contractor Redlined Site Development Drawings (Survey) -
         Full size hard copy format (1 set)

3) 100% Construction Documents (final CDs not for review) i.e. Bid Set
   (a) The CAD Office requires a complete set of documents as specified in
   the standard CU Architect/Engineer Contract including:
      (1) AutoCAD drawings in electronic format (.DWG and .PDF)
      (2) Full size hard copy format (1 set) – Stamped
      (3) Building Information Models (BIM) in Revit format (.rvt) (projects
          with a construction budget over $2 million)
      (4) Specifications - submit electronically in PDF format as one
document, OCR searchable, bookmarked according to CSI
          standards

4) Record Documents:
   (a) When the project has been completed, the Consultant shall submit a
   complete set of record construction documents as specified in the
standard CU Architect/Engineer Contract including:

1. AutoCAD Record drawings in electronic format (.DWG and .PDF)
2. Record drawings – Hardcopy 1 set
3. Revit produced projects shall include the Revit model reflecting the changes outlined in the redlined drawings.
4. Redlined construction drawings (hard copy)
5. Fire Systems shop drawings
6. Fire Suppression (sprinkler/standpipe) system (hardcopy - 1 set, .DWG and PDF)
7. Fire Detection/Alarm system (hardcopy - 1 set, .DWG and PDF)
8. Specifications - submit electronically in PDF format as one document, OCR searchable, bookmarked according to CSI standards
9. Operations and Maintenance Manuals – all disciplines - submit electronically in PDF format as one document, OCR searchable, bookmarked according to CSI standards

4. VALIDATION OF DELIVERED MATERIALS

a) The CAD Office will validate the CAD data and other materials submitted by consultants. If submittals do not conform to the UCB Facilities Management CAD Standards Guidelines, the CAD Office may return the materials to the consultant. The consultant is responsible for revising the materials to make them conform to the UCB Facilities Management CAD Standards Guidelines.

b) Use the e-transmit command within AutoCAD. See 2.A.11.a.5.

c) The Project Manager (PM) shall withhold final payment until all closeout documents have been received from all parties. Refer to http://www.colorado.edu/facilitiesmanagement/pdc/construction/documents/CloseoutProcess10-26-05.pdf for complete information.

5. COMMUNICATION ABOUT THE CAD STANDARDS

a) These CAD Standards will be most effective for consultants if there is communication between consultants and the University Owner's Representative. Consultants should ask questions about the CAD data standards before beginning work. Direct questions to the CAD Office. Concerns regarding the impact of the CAD standards on a particular project must be discussed with the Owner's Representative. Consultant’s questions are valuable because they help the CAD Office understand the real-world conditions of each project's design and construction process. Questions will raise issues that will result in better CAD standards.

6. SUGGESTIONS FOR THE STANDARDS

a) The content of the manual is intended to be neither static nor all-inclusive and thus will be updated and enhanced annually as appropriate. Suggestions for
improvements are encouraged so that subsequent updates reflect the needs of the University. Submit suggestions, as well as any pertinent new information, which would enhance these standards, to the CAD Office client representative.

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<th>DESCRIPTION</th>
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<td>LIGHTING FIXTURES</td>
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</table>
PART 1 - GENERAL

1.1 RESPONSIBILITY

A. The Division 21, 22, 23 and 26 contractor(s) shall comply with the provisions of this section. The Division 21, 22 and 23 and 26 contractor(s) shall verify electrical service provided by the electrical contractor before ordering any mechanical equipment requiring electrical connections. Provide submittals of all mechanical equipment to Division 26 and 28 contractor(s).

B. The final responsibility for properly coordinating the electrical work of this section shall belong to the Division 21, 22 and 23 system contractor performing the work, which requires the electrical power.

1. Each contractor shall be responsible for providing power wiring for certain devices as described in the specifications and on the drawings. This work shall be provided by a licensed electrician in accordance with all of the applicable provisions of the Division 26 and 28 specifications, NEC and local codes.

1.2 WORK INCLUDED

A. Carefully coordinate the interface between Division 21 (Fire Protection), Division 22 (Plumbing Protection) and 23 (Mechanical HVAC and Controls) and Division 26 (Electrical) and 28 (Fire Alarm) before submitting any equipment for review or commencing installation.

B. This Division of the Specifications may also be referred to by other Divisions of the Specifications, or on the Contract Drawings.

1.3 DEFINITIONS

A. Automatic: Pertaining to a function, operation, process or device that, under specified conditions, functions without intervention by human operator.

B. Disconnect Switch: A mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from a power source.

C. Control Circuit/Power: The circuit which carries the electrical signals of a control apparatus or system directing the performance of the controller but does not carry the main power circuit.

D. Manual Operation: Operation by hand without the use of any other power.


F. PC: Plumbing Contractor = Division 22.

G. MC: Mechanical Contractor = Division 23 Contractor who furnishes motor.

H. TC: Temperature Controls = Division 23 Contractor who furnishes control.

I. EC: Electrical Contractor = Division 26 Contractor.

J. FA: Fire Alarm Contractor = Division 28 Contractor who furnishes Fire Alarm System.
K. **EP**: Electric to Pneumatic Converter.

L. **PE**: Pneumatic to Electric Converter.

1.4 **RESPONSIBILITY SCHEDULE**

A. **Responsibility**: Unless otherwise indicated, all motors and controls for Division 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

<table>
<thead>
<tr>
<th>ITEM -</th>
<th>Furnished Under</th>
<th>Set In Place Under</th>
<th>Power Wiring Under</th>
<th>Control Wiring Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHU Interior Marine Lights</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
</tr>
<tr>
<td>Equipment Motors</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>--</td>
</tr>
<tr>
<td>Automatically or Manually Controlled Starters/Contactors: (Note 4) -Separate -Factory Mounted and Wired</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
</tr>
<tr>
<td>Motor Speed Controllers: (Note 4) -Separate -Factory Mounted and Wired</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
</tr>
<tr>
<td>Disconnect Switches (Note 1)</td>
<td>EC</td>
<td>EC</td>
<td>EC</td>
<td>--</td>
</tr>
<tr>
<td>Thermal Overload Switches (Note 1)</td>
<td>EC</td>
<td>EC</td>
<td>EC</td>
<td>--</td>
</tr>
<tr>
<td>Switches (Manual or Automatic other than disconnect) (Note 2)</td>
<td>MC or TC</td>
<td>MC or TC</td>
<td>EC or TC</td>
<td>TC or MC</td>
</tr>
<tr>
<td>Control Relays (Note 2)</td>
<td>MC or TC</td>
<td>MC or TC</td>
<td>--</td>
<td>TC</td>
</tr>
<tr>
<td>Control Transformers</td>
<td>MC or TC</td>
<td>MC or TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Push Button Stations</td>
<td>MC</td>
<td>EC</td>
<td>EC</td>
<td>--</td>
</tr>
<tr>
<td>Thermostat and Controls: Integral with Equipment or Directly Attached to Ducts, Pipes, etc. (Note 2)</td>
<td>MC or TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
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<tr>
<td>Equipment in Temperature Control Panels</td>
<td>TC</td>
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<td>TC</td>
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<tr>
<td>Standalone Control Panels (BAS) (Note 6)</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Valve Motors, Damper Motors, Solenoid Valves, etc.</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>EP Valves or Switches, P.E. Switches, etc.</td>
<td>TC</td>
<td>TC</td>
<td>--</td>
<td>TC</td>
</tr>
<tr>
<td>Fire Alarm System (Note 3)</td>
<td>FA</td>
<td>FA</td>
<td>EC</td>
<td>FA</td>
</tr>
<tr>
<td>Fire Sprinkler Alarm (Note 3)</td>
<td>FP</td>
<td>FP</td>
<td>EC</td>
<td>FA</td>
</tr>
<tr>
<td>Duct System Smoke Detectors (Note 5)</td>
<td>FA</td>
<td>MC</td>
<td>--</td>
<td>TC/FA</td>
</tr>
<tr>
<td>Relays for Fan Control via duct detectors (Note 5)</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>TC</td>
</tr>
<tr>
<td>CO Sensors</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
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<tr>
<td>Control Air Compressor</td>
<td>TC</td>
<td>TC</td>
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<tr>
<td>Refrigerated Air Dryer</td>
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<tr>
<td>Equipment Interlocks</td>
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<td>TC</td>
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<td>TC</td>
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<tr>
<td>Fire/Smoke and Smoke Dampers (Note 7)</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>FA</td>
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</table>
### SECTION 230501/260501 MECHANICAL AND ELECTRICAL COORDINATION

<table>
<thead>
<tr>
<th>ITEM -</th>
<th>Furnished Under</th>
<th>Set In Place Under</th>
<th>Power Wiring Under</th>
<th>Control Wiring Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC: Mechanical Contractor</td>
<td>TC: Temperature Contractor</td>
<td>EC: Electrical Contractor</td>
<td>FA: Fire Alarm Contractor</td>
<td></td>
</tr>
<tr>
<td>Positive Indication Devices (i.e., current sensors, end switches, airflow sensors)</td>
<td>TC</td>
<td>TC</td>
<td>--</td>
<td>FA/TC</td>
</tr>
</tbody>
</table>

**Notes:**

1. If furnished as part of factory wired equipment furnished and set in place by MC, wiring and connections by EC.
2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished by MC, but they shall be set in place and connected by EC, except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be furnished and set in place by MC and connected by EC. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired by TC contractor.
3. Pre-action system initiation signals (such as smoke detectors, or general alarm conditions in a pre-action zone) shall be provided under Division 28.
4. Electrical contractor is responsible for wiring from starter to motor, unless factory wired.
5. Temperature control contractor shall provide conduit and wire from auxiliary contact in motor starter to the detector so that the unit shuts down in all operating modes. Fire Alarm Contractor to wire from detector to fire alarm panel.
6. Each division shall be fully responsible for any control panels as called for on the drawings or specifications.
7. Division 23 and 26 shall provide all power and control wiring to fire/smoke or smoke dampers along with initiation signals to temperature control panels as described in the specifications.
8. TC wiring required only when damper also serves HVAC system.
9. TC wires to components utilized in the control and monitoring of the Automated Building Control System.

**B. Power Wiring by Division 23:** The electrical power for certain equipment provided under Division 23 has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the Division 23 or Division 22 or Division 21, whichever trade requiring such power.

Sufficient power for this purpose shall be furnished as “spare” dedicated circuit capacity in Division 26’s panelboards. All wiring, conduit and electrical devices downstream of the panelboards is the responsibility of the Division 23 trade requires the power.

1. Such equipment is hereby defined as:
   a. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings.
   b. Fire protection air compressors, dry-pipe control panels and valves. Required connections are to be included in the Division 21 work, and will be shown by that contractor’s engineered system design drawings.
      1) Pre-action system initiation signals (such as smoke detectors, or general alarm conditions in a pre-action zone) shall be provided under fire alarm work.
2) Division 21 shall provide pre-action control panel and interconnection between nearest suitable fire alarm panel and location of pre-action valve(s).

2. Temperature control panels, control air compressors and line voltage power for 24v control transformers. Required connections are included in Division 23 and will be shown by that contractor’s control submittal drawings.

1.5 GENERAL REQUIREMENTS

A. Remote Switches and Pushbutton Stations:
   1. Provide remote switches and/or pushbutton stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.

B. Special Requirements:
   1. Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

C. Identification:
   1. Provide identification of purpose for each switch and/or pushbutton station furnished. Identification may be either engraved plastic sign permanently mounted to wall below switch, or stamping on switch cover proper. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate area.

D. Control Voltage:
   1. Maximum allowable control voltage 120V. Fully protect control circuit conductors in accordance with National Electrical Code.

E. DDC Control Interface:
   1. Fully coordinate the requirements of each division with regard to supplying a complete DDC Control System prior to submitting bid.
   2. All control power shall be furnished via dedicated line voltage circuits.
   3. Low voltage wiring from J-boxes to distributed control components, all low voltage connections, all control panels and all control transformers (not part of unitary equipment) shall be provided under Division 23.
   4. Any additional power requirements shall be the responsibility of the Division 23 Contractor requiring same, and provided at no additional cost to the owner.

1.6 CEILING AND CHASE CAVITY PRECEDENCE

A. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of precedence. A system with higher precedence may direct that systems of lower precedence be relocated from space, which is required for expedient routing of the precedent system.

   1. Plumbing waste, cooling coil drain piping, and roof drain mains and leaders.
2. Steam and condensate piping.
3. Hydronic main piping (12” and larger).
4. Plumbing vent piping.
5. Supply, return and exhaust ductwork.
6. Electrical conduit greater than 4” diameter.
7. Hydronic branch and mains (greater than 2”, but less than 12”).
8. Domestic water piping.
9. Fire sprinkler mains and leaders.
10. Hydronic branch piping (2” and less).
11. Domestic hot and cold water branches.
12. Electrical conduit branch feeders.
13. Pneumatic control piping.
14. Fire sprinkler branch piping and sprinkler runouts.

B. Light fixtures have precedence in a zone, which is the same height above the ceiling as the depth of the fixture (plus 2”).

C. Examine the contract documents of all trades (e.g. all Division 21, 22, 23, 26 and 28 drawings, the architectural floor plans, reflected ceiling plans, elevations and sections, structural plans and sections, etc.).

D. Coordinate necessary equipment, ductwork and piping locations so that the final installation is compatible with the materials and equipment of the other trades.

E. Prepare shop drawings for installation of all new work before installation to verify coordination of work between trades.

F. Provide access doors for all equipment, valves, clean-outs, actuators and controls which require access for adjustment or servicing and which are located in otherwise unaccessible locations.

1. For equipment located in “accessible locations” such as lay-in ceilings: Locate equipment to provide adequate service clearance for normal maintenance without removing architectural, mechanical, electrical or structural elements such as the ceiling support system, electrical fixtures, etc. “Normal maintenance” includes, but is not limited to: filter changing; greasing of bearings; using p/t ports for pressure or temperature measurements; and replacement of ballasts, fuses, etc.

PART 2 – PRODUCTS

2.1 MOTOR HORSEPOWER

A. In general, all motors ¾ HP and above shall be three phase, all motors ½ HP or less shall be single phase.

B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or general condition 2.1. A., above.
C. Work under Divisions 21, 22 or 23 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Division 26, before ordering the equipment.

1. If motor horsepowers are changed under the work without a change in duty of the motor’s driven device, coordination of additional electrical work (if any) and additional payment for that work (if any) shall be provided under the section of that Division initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Architect/Engineer.

PART 3 - EXECUTION - (Not Used)

END OF SECTION 230501/260501
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. This Section supplements Division 1, General Requirements.
   B. Where contradictions occur between this Section and Division 1, the most stringent of the two shall apply. Architect shall decide which is most stringent.
   C. Provisions of Divisions 21, 22, 23 and 28 shall also apply to the work of this section as if fully repeated here.
   D. Provision indicate Section 23 05 01/26 05 01 “Mechanical and Electrical Coordination” shall also apply to the work of this section as if fully repeated here.

1.2 REGULATORY REQUIREMENTS
   A. All materials shall conform with the current applicable industry standards. Workmanship and neat appearance shall be as important as electrical and mechanical operation. Defective or damaged materials shall be replaced or repaired prior to final acceptance in a manner meeting approval of the Architect and at no additional cost to the Owner.
   B. The latest editions of the following standards are minimum requirements.
      1. Underwriters’ Laboratories, Inc. (UL)
      2. National Electrical Manufacturer’s Assoc. (NEMA)
      3. American National Standards Institute (ANSI)
      4. Institute of Electrical and Electronic Engineers (IEEE)
      5. International Electrical Testing Association (NETA)
      6. Insulated Cable Engineer’s Association (ICEA)
      7. University of Colorado at Boulder (UCB) Standards
   C. All work and materials shall comply with latest rules, codes and regulations including, but not limited to the following:
      1. OSHA
      2. National Fire Codes of National Fire Protection Assoc. (NFPA)
      7. All applicable Federal, state and local laws, code amendments and regulations.
   D. Code compliance is mandatory. Nothing in these drawings and specifications permits work not conforming to these codes.
   E. No work shall be concealed until after inspection and approval by proper authorities. If work is concealed without inspection and approval, Contractor shall be responsible for all work required to open and restore the concealed area including all required modifications.
   F. Contradictions: Where Codes are contradictory, follow the most stringent. Architect/Engineer shall determine which is most stringent.
1.3 CONTRACT DOCUMENTS

A. Drawings indicate general arrangement of circuits and locations of outlets, conduit, and other work. Information shown on drawings is as accurate as planning can determine, but not guaranteed and field verification of all dimensions, locations, levels, etc., to suit field conditions is directed. Review all architectural and mechanical drawings, and adjust all work to conform to all conditions shown therein. Architectural drawings shall take precedence over all other drawings. Discrepancies between different drawings or between drawings and specifications or regulations and codes governing installation shall be brought to attention of the Architect and Engineer prior to installation.

B. Where the Drawings and Specifications do not comply with the minimum requirements of the Codes, either notify the Architect/Engineer in writing during the Bidding Period of the revisions required to meet Code requirements, or provide an installation which complies with the Code requirements. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

C. Follow Drawings and Specifications where they are superior to Code requirements. The more stringent of plans and drawing shall apply.

1.4 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 “Submittals” to a scale of \( \frac{1}{4}'' = 1' - 0'' \) or larger; detailing major elements, components, and systems of electrical equipment (i.e., all switchgear rooms, generator yard, electrical rooms and telephone rooms) and materials in relationship with other systems, installations, and building components. Where equipment is located outdoors, prepare shop drawings indicating electrical equipment locations and exterior elements in the equipment areas. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important to the efficient flow of the work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, and materials. Include the following:
   a. Exterior wall and foundation penetrations.
   b. Fire-rated wall and floor penetrations.
   c. Support details.
   d. Sizes and location of required concrete pads and bases.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installation.

4. Electrical Rooms indicating conduit stub-up locations and bus riser location.

5. Cable tray floor plans and elevations showing exact routing.

1.5 RECORD DRAWINGS

A. Refer to Division 1 for additional requirements.
B. Maintain a blue-line set of Electrical Contract Drawings in clean, undamaged condition, for mark-up of installations which vary from the Contract Drawings. These drawings shall be a separate set of drawings, not used for construction purposes, and shall be kept up to date as the job progresses. This set shall be made available for inspection by the Engineer or Architect at all times. Upon completion of the contract a set of computerized “as built” capable of interfacing with AutoCAD software, shall be delivered to the Architect.

C. Prepare record documents in accordance with the requirements in Division 1 Section “Project Closeout.” In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size and location, interior conduit stub-up locations.
2. Panelboard circuit directories reflecting all field changes.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Results of all testing performed as specified in the specification.
5. Certification of inspection from Authorities Having Jurisdiction.

D. Record the locations and invert elevations of underground installations.

1.6 OPERATING AND MAINTENANCE MANUALS

A. Refer to Division 1 for additional requirements.

B. Submission:

1. Submit three typed and bound copies of Operating and Maintenance Manuals prior to scheduling systems demonstration for the Owner.
2. Bind each Maintenance Manual in one or more vinyl covered, 3-ring binders, with pockets for folded drawings.
   a. Mark the back spine of each binder with system identification and volume number.

C. Requirement Contents:

1. Manuals shall have index with tab dividers for each submittal section identifying all equipment and materials installed on the project including a local supplier for replacing a specific piece of equipment.
2. Provide certificates for such items of equipment which have warranties in excess of one year.
3. Provide test results for each specification section identified herein.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Protection of Equipment:

1. All electrical equipment to be used in the construction shall be properly stored and protected against the elements. All equipment shall be stored under cover, and shall not be stored at the construction site on the ground, in mud, water, rain, sleet, or dust. Large diameter cables may be stored on reels outside; however, all cable ends shall be
waterproofed and the reels covered with weatherproof materials. Such weatherproof materials shall be heavy-duty, securely fastened, and made impervious to the elements.

2. Conventional electrical construction materials such as building wire, outlet and junction boxes, wiring devices, conduit, lighting fixtures, fittings, etc., shall be stored in construction buildings, covered trailers, or portable covered warehouses. Any equipment subject to damage or corrosion from excessive moisture shall be stored in dry, heated areas. Any equipment containing plastic or material subject to damage caused by excessive heat or sunlight shall be stored to prevent such damage. This includes plastic ducts and lenses.

3. Equipment damaged as a result of the above conditions shall be properly repaired at the contractor’s expense or shall be replaced at the contractor’s expense, if in the opinion of the Engineer, the equipment has been damaged to such an extent that it cannot operate properly after repairs are made.

4. All electrical enclosures exposed to construction damaged such as paint spots, spackling or plaster spatter, grout splashes, waterproofing compound, tar spots or runs, and pipe covering compound splashes, shall be completely covered and protected against damage.

5. In the event leakage into the building of any foreign material or fluid occurs or may occur, the contractor shall take all steps as described above to protect any and all equipment.

6. After connections to electrical equipment are complete and the equipment is ready for operation, all construction debris shall be removed from all enclosures. Such debris includes dust, dirt, wire clippings, tape, and insulation removed in order to make the connection.

1.8 SAFETY AND INDEMNITY

A. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. See also General Conditions.

B. No act, service, drawings review or construction review by the Architect or Engineer, is intended to include review of the adequacy of the Contractor’s safety measures in, on, or near the construction site.

1.9 WARRANTIES

A. The warranty period is generally one year after Date of Acceptance.

1. During this period, provide labor and materials as required to repair or replace defects in the electrical systems at no cost to the Owner. Provide certificate with O & M manual submittal which guarantees same day service response to the Owner’s call for such warranty service.

2. Provide certificates for such items of equipment which have warranties in excess of one year. Insert copies of O & M manual. Such equipment shall include:

   a. Lighting fixtures
   b. Fire alarm system
   c. Network lighting control

3. Provide extended manufacturers warranties to cover one full year from Date of Acceptance if standard manufacturers’ warranty ends any time prior to that date.
PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment and materials installed shall be new, unless otherwise specified.

B. All major equipment components shall have manufacturers’ name, address, model number and serial number permanently attached in a conspicuous location.

C. All equipment shall be UL listed and bear the UL label.

2.2 GENERAL SUBMITTAL REQUIREMENTS

A. Coordination and Sequencing:

1. After receipt of notice to proceed, the Contractor shall submit to the Architect a typed list of submittals and the scheduled date of submission. List shall include submittal number, section number and scheduled date of submission. Submittals shall be grouped and submitted in no more than ten complete packages.

2. The contractor shall not submit any shop drawings or product data that does not comply with the contract documents. Prior to submitting shop drawings, review submittal for compliance with Contract Documents and place a stamp or other confirmation thereon which states that submittals have been reviewed. Submittals without such verification will be returned disapproved without review.

3. Submittal is for information and record, unless otherwise indicated, and is not a change order request.

B. Preparation of Submittals:

1. Refer to Division 1 requirements.

2. The Contractor shall submit for approval by the Architect data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable. Provide complete electrical characteristics for all equipment. Submit product submittals on items as outlined in sections hereinafter.

3. Product submittals shall be made by specification section.

4. Each individual submittal items within a binder shall be marked to show section number which pertains to the item.

5. Provide permanent marking on each binder identifying project name, Contractor, Subcontractor, submittal name, date of submission, specification section, and information to distinguish it from other submittals.

6. Section binders shall be report cover type with solid cover and 3 metal fasteners. Binders shall also have a tab indicating submittal number and specification section number. If product submittals for section exceed the capacity of one binder, two or more binders shall be used. In addition, a notation cover shall indicate the number of binders for the section and number of that binder (i.e., 2 or 3). Binders shall have rigid cover and be of appropriate size.

7. Submittals not presented in a bound, neat and legible fashion will returned "Without Action."
8. Submittals shall show Contractor’s executed review and approval marking. Submittals which are received from sources other than through Contractor’s office will be returned “Without Action.”


C. Substitutions

1. Refer to the General Conditions, which governs “Substitution” of specified equipment or materials.

2. Indicate any portions of work which deviate from the Contract Documents.
   a. Explain the reasons for the deviations.
   b. Show how such deviations coordinate with interfacing portions of other work.

3. Where substitution of materials alters space requirements indicated on the drawings, submit shop drawings indicating proposed layout of space, all equipment to be installed therein and clearances between equipment (i.e., electrical rooms). All clearances required by the National Electrical Code and applicable state and local regulations must be maintained.

D. Review Process

1. The Architect reserves the right to require a sample of any equipment to be submitted for approval and to retain its possession.

2. Refer to the individual sections for identified equipment and material for which submittals are required. In addition, provide shop drawings and product data on the following equipment:

   - Electrical Power Conductors and Cables
   - Hangers and Supports
   - Raceway and Boxes
   - Identification
   - Network Lighting Control
   - Wiring Devices
   - Fuses
   - Lighting Fixtures
   - Enclosed Switches and Circuit Breakers
   - Fire Alarm System

   Do not submit on equipment or materials not requested in the specifications.

3. Review of shop drawings and product data by the Architect/Engineer, including any review annotations or stamp notations, does not relieve the contractor from the required compliance with the contract documents.

4. The shop drawing and product data review stamp notation requirements are defined as follows:
   a. “NO EXCEPTION TAKEN:” The reviewer did not observe any items which were not in compliance with the contract documents. All dimensions, details, and coordination with other trades is the responsibility of the contractor.
   b. “MAKE CORRECTIONS NOTED:” The reviewer indicated items observed that were not in compliance with the contract documents. The contractor shall not resubmit, but shall make corrections and provide corrected documents with the “Record Drawings.”
c. “REJECTED, REVISE AND RESUBMIT:” The reviewer indicated items observed which were not in compliance with the contract documents. The contractor shall resubmit showing corrections of all noted items. Delays for resubmittal does not relieve the contractor from meeting project schedules.

d. “REJECTED:” The submission does not comply with the contract requirements. The entire submittal must be corrected and submitted for review. Delays for resubmittal does not relieve the contractor from meeting project schedules.

5. If shop drawings are submitted and returned as “NO EXCEPTION TAKEN” or “MAKE CORRECTIONS NOTED” and meet contract requirements, the contractor shall not resubmit any other shop drawings for these items.

6. If resubmittals are necessary, they shall be made as specified above for submittals. Resubmittals shall highlight all revisions made and cover shall include the phrase “RESUBMITTAL NO. ______________.”

Resubmittal requirements do not entitle the Contractor to additional time and are not a cause for delay of the project.

PART 3 – EXECUTION

3.1 CONDITIONS AT SITE

A. Visit to site is required of all bidders prior to submission of bid. All bidders will be held to have familiarized themselves with all discernible conditions, and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

B. Lines of other services and/or equipment that are damaged as a result of this work shall promptly be repaired at no expense to the Owner.

3.2 LICENSES, FEES AND PERMITS

A. Arrange for required inspections and pay all license, permit and inspection fees. Furnish a certificate of final inspections and approvals from local authority having jurisdiction over electrical installation.

3.3 WORKMANSHIP AND CONTRACTOR’S QUALIFICATIONS

A. Only professional quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.

B. Provide foreman in charge of this work at all times. Foremen for this work shall have had experience in installing not less than 5 such electrical systems of equal or greater complexity.

C. Where specifications call for an installation to be made in accordance with manufacturers’ recommendations, a copy of such recommendations shall at all times be kept in job superintendent’s office.
3.4 RELATION WITH OTHER TRADES

A. Contractor shall coordinate work of this Division with other trades to avoid conflict and to provide rough-ins and other connections for equipment furnished under other divisions that require electrical connections. Inform other trades of required clearances of accesses for or around electrical equipment to maintain serviceability and code compliance.

B. Verify equipment dimensions and rough-in requirements for Divisions 2 through 28 with provisions specified under this Section of work, and report discrepancies to the Architect in ample time to prevent delays or unwarranted changes of work.

3.5 TESTING

A. Provide all labor, materials, and equipment necessary to make required tests. Tests shall be complete and results approved before final inspection is begun.

3.6 PROGRESS OF WORK

A. Order progress of electrical work so as to conform to progress of work of other trades, and complete entire installation as soon as condition of building will permit. Assume any cost resulting from defective or ill-timed work performed under this Division.

3.7 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section “Cutting and Patching.” In addition to the requirement specified in Division 1, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
   a. Uncover work to provide for installation of ill-timed work.
   b. Remove and replace defective work.
   c. Remove and replace work not conforming to requirements of the Contract documents.
   d. Remove samples of installed work as specified for testing.
   e. Install equipment and materials in newly installed structures.
   f. Upon written instructions from the architect, uncover and restore work to provide for Architect observation of concealed work.

3.8 SLEEVES

A. Place sleeve in forms of walls, floor slabs and partitions for passage of all conduits, pipes, and ducts installed under Divisions 26, 27 and 28. Sleeves shall be set in place a sufficient time ahead of concrete work so as not to delay that work. Install sleeves and raceways through exterior walls so as to provide a waterproof installation. All floor penetrations shall be made watertight. Conduits passing through walls shall be installed to preserve integrity of the wall rating (i.e., fire rating, sound rating, air, etc.). All penetration made through existing concrete slabs or walls shall be x-rayed and approved by Structural Engineer prior to cutting.
3.9 EXCAVATION, TRENCHING, AND BACKFILLING

A. Perform all excavation to install conduit and duct banks indicated on the drawings or specified herein. During excavation, pile material for backfilling back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. Remove and dispose of all excavated materials not to be used for backfill. Grade to prevent surface water from flowing into trenches and excavation. Remove any water accumulating therein by pumping. Do all excavation by open cut. No tunneling shall be done unless indicated on the drawings or unless written permission is received from the Architect.

B. Grade the bottom of trenches to provide uniform bearing and support for conduits or duct bank on undisturbed soil at every point along its entire length. Tamp over depths with loose, granular, moist earth. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.

C. Backfill the trenches with excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale. These materials should be free from large clods of earth and stones, deposited in 6" layers and rammed until the installation has cover of not less than the adjacent ground but not greater than 2" above existing ground. Backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. Compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material. Do not settle backfill with water. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore surface to grade and compaction indicated on the drawings, mounded over and smoothed off.

D. In addition, all excavation and backfilling shall comply with Division 2. The most stringent requirement shall apply.

3.10 CLEANUP

A. Remove all materials, scrap, etc., relative to electrical installations and leave premises in a clean, orderly condition. Any costs to the Owner for cleanup of site will be charged to the Contractor. At completion, all equipment, raceways, etc., shall be thoroughly cleaned and all residue removed from the inside and outside surfaces. Defaced finish shall be refinished.

3.11 TEMPORARY POWER

A. Provide temporary power as requested by the general contractor and in accordance with OSHA and local code requirements. Lighting and power outlets shall be provided throughout the project. Check with construction manager or general contractor prior to bid for special lighting and power outlets and provide as needed.

3.12 MINOR CHANGES

A. The Owner reserves the right to make minor changes in the locations of outlets and equipment up to the time of electrical rough-in without any cost to the Owner.
3.13 ELECTRICAL SYSTEMS OPERATIONAL TESTS, CERTIFICATION, AND DESIGN AUTHORITY ASSISTANCE

A. Testing

1. Refer to the individual specification sections for test requirements.
2. Prior to the final inspection, the systems or equipment shall be tested and reported as herein specified. Six (6) typewritten copies of the tests shall be submitted to the Architect/Engineer for approval.
3. All electrical systems shall be tested for compliance with the specifications.

B. Manufacturers’ Certifications

1. The electrical systems specified herein shall be reviewed for compliance with these specifications, installation in accordance with the manufacturers’ recommendations and system operation by a representative of the manufacturer. The manufacturer shall submit certification that the system has been installed in accordance with the manufacturers’ recommendations and is operating as specified in the contract documents.
2. Provide manufacturers’ certification for the emergency generator set/automatic transfer system, central dimming controls, network lighting control and fire alarm system.

C. Design Authority Assistance

1. The Contractor shall provide personnel to assist the Architect/Engineer or his representative during all construction review visits. The Contractor shall provide all necessary tools and equipment to demonstrate the system operation and provide access to equipment, including screwdrivers, wrenches, ladders, flashlights, circuit testing devices, meters, keys, etc.
2. Remove equipment covers (i.e., switchgears, switchboards, panelboard trims, panelboards, motor controls, device plates, and junction box covers) as directed for inspection of internal wiring. Accessible ceiling shall be removed as directed for inspection of equipment installed above ceilings. Reinstall all covers or ceilings after inspection.
3. Energize and de-energize circuits and equipment as directed. Demonstrate operation of equipment as directed by Architect/Engineer.
4. The Contractor shall provide authorized representatives of the manufacturers to demonstrate to the Architect/Engineer compliance with the specifications of their respective system during or prior to the final inspection at a time designated by the Architect. Refer to the appropriate specification section for additional testing requirements. Representatives of the emergency generator/automatic transfer switch and fire alarm systems are required for demonstrations.

3.14 COMMISSIONING

A. After startup and testing of each system has been completed, the Owner shall conduct detailed observations of the equipment and systems to confirm compliance with the Contract Documents.

B. The Division 26 Contractor shall include, as part of the work of his contract, costs to cover manpower, equipment, tools, ladders, instruments, etc., necessary to expedite the system performance observations.
C. The Owner shall develop systems, equipment checkout procedures and data forms for recording compliance of the systems to the Contract Documents, performance, and construction observation lists, and will assist in developing schedules for checkout and Owner acceptance, at a future date during the construction phase.

END OF SECTION 260502
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section supplements Division 1, General Requirements. Where contradictions occur between this Section and Division 1, the more stringent of the two shall apply. The Architect shall decide which is most stringent.

B. Requirements of the following Divisions and Sections apply to this Section:
   1. Division 26 Section 26 05 02 “Electrical Requirements.”
   2. Division 9 Section “Painting” for related requirements.

C. Refer to other Division 26 Sections for additional specific electrical demolition or relocation associated with specific items.

1.2 SUMMARY

A. This Section includes basic requirements for demolition and relocation of electrical materials, equipment, and installations. The Contractor shall be responsible for visiting the site prior to bid to determine the actual conditions, which might affect the bid or contract price. No allowance will be made subsequently resulting from the neglect to visit the site and make such determinations.

B. Generally, electrical items that are to be replaced with other equipment in the same location is work covered by this section. Also covered by this section are electrical items that are to be removed in their entirety or that are to be relocated to another place.

1.3 UTILITY SERVICES

A. Maintain existing utility services. Where necessary to cut existing conduits, wires, cables, etc. of utility services or fire protection systems, they shall be cut and capped at suitable places or where directed by the Owner’s representative.

B. Electrical service in demolition area shall be reduced to a minimum and identified to eliminate uncertainty about which circuits are energized.

C. The Contractor shall notify the Owner’s representative in writing of any planned utility interruptions including interruptions of power to communications and fire protection systems at least 72 hours in advance or as otherwise specified. The request shall state the reason, date, beginning time, and expected duration of such interruptions. No interruptions shall be made without the Owner’s written concurrence and such interruptions shall be coordinated with the Owner to cause the least inconvenience to the Owner’s operations. Service interruptions which cannot wait for written approval may be granted with verbal approval from the Owner’s representative. After verbal approval is granted, written confirmation shall be issued by the Contractor as soon as practical.
1.4 PROTECTIVE MEASURES

A. Provide the following protective measures:

1. Wherever existing roofing surfaces are penetrated by electrical conduit, they shall be protected against water infiltration. Water leaks shall be repaired immediately upon discovery when they occur.
2. Temporary protection against damage for all portions of existing structures and grounds where work is to be done, materials handled, and equipment moved or relocated.
3. Contractor shall patch and fill openings in floors, walls and ceilings for removed equipment or piping with the same material, fire and structural integrity that would have existed prior to the penetration including concrete, block, gyp wallboard, exterior walls, roof membranes, etc. except for steel and wood beams which shall have the openings capped with similar material.

B. The Contractor shall be responsible for contacting utilities or locating services and obtaining locations of all underground services in the general area of demolition work.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. The Contractor shall provide all equipment and materials necessary for the removal or relocation of electrical equipment.

B. Materials used in restoration or repairing work related to demolition and relocation shall conform in type, quality, and function to that of the original existing construction or as otherwise indicated.

2.2 DISPOSAL AND RETENTION

A. Materials and equipment resulting from work and removed from the building or structures, or parts thereof, shall become the property of the Contractor and shall be removed from the site by the Contractor except as follow:

1. Light fixtures, lamps, and ballasts.
2. Fire, heat, and smoke detection devices.
3. Telephones and telephone equipment other than outlet devices.
4. Fire alarm notification devices and pull stations.
5. Paging speakers, clocks, and intercom call stations.

B. Items removed or noted to be retained by the Owner but which are declined to be retained by the Owner shall be removed from the site by the Contractor.

C. Combustible waste material and rubbish shall not be stored or allowed to accumulate within a building or its vicinity, but shall be kept in a suitable trash container for subsequent removal or shall be removed from the premises as rapidly as practical.

D. All hazard waste shall be properly disposed of by a licensed hazard waste disposal facility. Items shall include but not limited to fluorescent lamps, diesel fuel, radiator coolant, etc.
PART 3 - EXECUTION

A. Remove or relocate all items indicated on the drawings or as otherwise indicated.

B. Where the drawings indicate that equipment is to be replaced or where other equipment requires the relocation of existing equipment, the existing equipment shall be removed or relocated as though it was specifically noted to be removed or relocated.

C. Wherever electrical materials have been removed from surfaces of the building or structure, those surfaces shall be patched and repaired.

D. Remove, cut, alter, replace, patch, and repair existing work as necessary to install new work. Unless otherwise indicated or specified, do not cut, alter, or remove any structural members, ducts, piping, or service lines without approval of the Owner’s representative.

E. Existing work or equipment to be altered or extended and found to be defective shall be reported to the Owner’s representative before it is disturbed or any further work is performed on it.

F. Where electrical equipment is indicated to be removed or relocated, the work shall include the complete disconnection from its source, dismantling as necessary, and removal or installation of all conduit, wires, cables, etc. Unless noted otherwise, wires shall be removed from conduits back to the last utilization device or to the panelboard. No wiring shall be removed that prevents operation of other equipment not scheduled or indicated to be removed.

G. Perform and schedule all demolition work with other trades and work of the contract as necessary for the efficient progress and flow of the work.

END OF SECTION 260504
PART 1 - GENERAL

1.1 DESCRIPTION

A. The following lists of manufacturers are for the specifications as identified.

B. All submittals and documentation shall be in accordance with the project General Requirements, Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are listed herein. All manufacturers not listed shall be pre-approved prior to bid in order to be considered. Refer to Division 1 for pre-approval format.

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<tr>
<th>TITLE</th>
<th>SPECIFICATION SECTION</th>
<th>MANUFACTURER</th>
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<tr>
<td>Grounding and Bonding</td>
<td>26 05 26</td>
<td>Cadweld Div.; Cooper Industries</td>
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<td>Ideal Industries</td>
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<td>Burndy Electrical</td>
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<td>Hangers and Supports</td>
<td>26 05 29</td>
<td>American Electric</td>
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<td>B-Line Systems, Inc.</td>
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<td>Unistrut Diversified Products</td>
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<td>26 05 29</td>
<td>OZ/Gedney Co.</td>
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<td>RACO, Inc.</td>
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<td>Spring City Electrical Mfg.</td>
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<td>Thomas and Betts Corp.</td>
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<td>Raceways</td>
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<td>Allied Tube &amp; Conduit</td>
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<td>Crouse-Hinds Div.</td>
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<td>Hubbell/Killark Electric</td>
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<td>OZ/Gedney Co.</td>
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<td>Thomas &amp; Belts/Steel City</td>
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<td>TITLE</td>
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<td>Wireway and Enclosures</td>
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<td>Cooper B-Line</td>
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<td>Hoffman Engineering Co.</td>
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<td>Surface Raceways</td>
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<td>Hammond Mfg.</td>
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<td>The Wiremold Co.</td>
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<td>Electrical Power Conductors and Cables</td>
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<td>Southwire Co.</td>
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<td>Okonite Co.</td>
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<td>Aetna Insulated wire</td>
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<td>Electrical Boxes and Fittings</td>
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<td>Raintight outlet boxes</td>
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<td>Appleton Electric Co.</td>
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<td>Crouse - Hinds</td>
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<td>RACO Div.; Hubbell, Inc.</td>
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<td>Thomas &amp; Belts/Steel City</td>
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<td>Bushings, knockout closures and locknuts</td>
<td>26 05 33</td>
<td>Appleton Electric Co.</td>
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<td>Midland-Ross Corp.</td>
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<td>Midwest Electric</td>
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<td>Thomas &amp; Betts Co., Inc.</td>
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<tr>
<td>Identification</td>
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<td>Ideal Industries, Inc.</td>
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<td>Panduit Corp.</td>
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<tr>
<td>Network Lighting Controls</td>
<td>26 09 43</td>
<td>Intelligent Lighting Controls (ILC)</td>
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<tr>
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<tr>
<td>- Receptacles and Switches</td>
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<td>Cooper Wiring Devices</td>
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<td>- Dimmers</td>
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<td>- Occupancy Sensors</td>
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<td>Fuses (See Note)</td>
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<td>Bussman (Basis of Design)</td>
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<td>Lighting Fixtures</td>
<td>26 51 13</td>
<td>Refer to Drawings</td>
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NOTE: Contractor shall submit fuse coordination for the entire electrical distribution if alternate manufacturer is used.

PART 3 - EXECUTION - Not Used.

END OF SECTION 260505
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. This Section supplements Division 1, General Requirements.

1.2 DESCRIPTION OF WORK
   A. Work included in this section consists of conduits, wires and other miscellaneous materials not specifically mentioned in other sections of Division 26 but necessary or required for equipment or system operation or function, and the labor to install them.

1.3 SUBMITTALS
   A. Materials list with manufacturer, style, series or model identified.
   B. Manufacturer’s descriptive literature and/or sample if requested by the Architect/Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Refer to Section 26 05 05.

2.2 CONDUIT RACEWAYS: Refer to Section 26 05 33.

2.3 ELECTRICAL POWER CONDUCTORS AND CABLES: Refer to Section 26 05 19.

2.4 WIRING DEVICES: Refer to Section 26 27 26.

2.5 OUTLET BOXES, JUNCTION AND PULL BOXES
   A. Outlet Boxes: Hot-dipped galvanized or sherardized of required size, 4” square minimum, for flush mounted devices and lighting fixtures. Cast-type FD with gasketed covers for surface-mounted devices.
   B. Junction and Pull Boxes: Use outlet boxes as junction boxes wherever possible. Larger junction and pull boxes shall be fabricated from sheet steel, sized according to code, with screw-on covers, galvanized where required for outdoor exposure.
   C. All exterior boxes shall be cast, gasketed, weatherproof type with cast covers.
   D. Refer to Section 26 05 33 for additional requirements.
2.6 WIRE CONNECTORS

A. For wires that are #8 AWG and smaller: Insulated pressure type with live spring, rated 105°C, 600 volt, for building wiring and 1000 volt in signs or fixtures.

B. For wires that are #6 AWG and larger: Compression type with 3M #33 or equal tape insulation.

2.7 CONDUIT HANGERS

A. Galvanized steel with special accessories for purpose and adequate to support load imposed. Support individual conduit 1-1/2-inch and larger and all multiple conduit runs with hangers. Clamp conduits individually to each support.

B. Refer to Section 26 05 29 for additional requirements.

2.8 FUSES: Refer to Section 26 28 16.

2.9 ACCESS PANELS

A. Electrical Contractor to provide access panels for electrical equipment which are required for accessibility by code.

2.10 TERMINAL CABINETS AND BACKBOARDS

A. Fabricate from code gauge steel, size as indicated on drawings, with flush latch and concealed hinge. Where size is not indicated, minimum size shall be 20” wide x 24” high x 4” deep. Finish shall be ANSI 61 light gray baked enamel.

B. Provide inside terminal cabinet, ¾” thick plywood backboard and terminal strips, one terminal point for each wire within the terminal cabinet.

2.11 CONDUIT SLEEVES

A. Sleeves for Conduit Penetration: Hilti, Inc., model CP 682. Refer to Division 7 “Firestopping" for additional requirements.

2.12 EQUIPMENT MOUNTING AND SUPPORT HARDWARE

A. Steel channels, bolts and washers, used for mounting or support of electrical equipment shall be galvanized typed. Where installed in corrosive atmosphere, stainless steel type hardware shall be used.

B. Refer to Section 26 05 29 for additional requirements.
PART 3 - EXECUTION

3.1 GENERAL

A. Provide complete raceway systems for all conductors including control wiring and low voltage wiring unless otherwise noted.

B. Electrical system layouts indicated on drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit. Govern exact routing of raceways and locations of outlets by structure and equipment served. Take all dimensions from architectural drawings.

C. All home runs to panelboards are indicated as starting from the outlet nearest to the panel and continuing in the general direction of that panel. Continue such circuits to panel as though routes were completely indicated.

D. Avoid cutting and boring holes through structure or structural members wherever possible. Obtain prior approval of the Architect, and conform to all structural requirements when cutting or boring structure.

E. Furnish and install all necessary hardware, hangers, blocking, brackets, bracing, runners, etc., required for equipment specified under this Section.

F. Furnish and install all raceways from elevator machine room to fire command center for elevator status.

3.2 RACEWAYS: Refer to Section 26 05 33.

3.3 OUTLETS

A. Exact location of outlets and equipment shall be governed by structural conditions and obstructions or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment. Verify final location of all outlets, panels, equipment, etc., with the Architect/Engineer.

B. Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4" octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8" no-bolt fixture studs. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Outlet boxes in finished ceilings or walls shall be fitted with appropriate covers, set to come flush with the finished surface. Where more than one switch or device is located on one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide tile box or a 4" square box with tile ring in masonry walls which will not be plastered or furred, or where “dry-wall” type materials are applied. Through the wall type boxes are not permitted. Install minimum 12” lateral separation for back to back boxes.

C. Surface-mounted devices are to be mounted in cast type boxes with gasketed covers: (Crouse-Hinds condulets or equal).
D. Dimensions unless shown on drawings are given below and are from finished floor to center line of outlets unless noted otherwise. Adjust heights of outlets in masonry walls to correspond with consistent brick or block course. Outlets in block walls shall be installed in core of block.

- Wall Switches: 4' - 0" (to top of switch)
- Convenience outlets: 1' - 6" (to bottom of outlet)
- Hallways: 1' - 6" (to bottom of outlet)
- Workroom wall outlet: 4' - 4" (field verify height of backsplash)
- Panelboards wall-mounted: 6' - 6" (to top of trim)
- Wall phone outlet: 4' - 0" (verify with technology drawings)
- Telephone outlets: 1' - 6" (verify with technology drawings)
- Fire alarm horns, speakers: ceiling or wall
- Fire alarm pull stations: 4' - 0" (to top of device)
- Fire alarm strobes: 6' - 8" or 6" below ceiling (whichever is lower)
- Television outlets: Refer to Technology or architectural drawing.

Confirm final location and heights of all outlets, wall switches, and television outlets with architectural and technology drawings and furniture plans prior to installation.

E. Outlets except over counters, benches, special equipment, baseboards, fin tube radiators, etc., or at wainscotting, shall be at a height to prevent interference to service equipment, or as noted on drawings.

F. Refer to Section 26 05 34 for additional requirements.

3.4 JUNCTION PULL BOXES

A. Construct junction or pull boxes not over 150 cubic inches in size shall be standard outlet boxes, and those over 150 cubic inches shall be constructed the same as "Cabinets," with screw covers of same gauge metal. Removal covers must be accessible at all times.

B. Provide a standard access panel having a hinged metal door neatly fitted into a flush metal trim, where a junction box or equipment is located above non-accessible ceilings or behind finished walls. Coordinate location and type with the Architect.

END OF SECTION 260506
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. Requirement of the following Division 26 Sections apply to this section:
   1. Electrical Requirements

1.2 SUMMARY
A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.
B. Related Sections: The following Sections contain requirements that relate to this section:
   1. Division 2 Section "Earthwork" for trenching and backfilling.
   2. Division 26 Section "Electrical Boxes and Fittings" for connectors for terminating cables in boxes and other electrical enclosures.

1.3 SUBMITTALS
A. Product Data for electrical wires, cables and connectors.

1.4 QUALITY ASSURANCE
A. Regulatory Requirements: Comply with provisions of the following code:
B. NFPA 70 "National Electrical Code."
   1. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.
C. UL Compliance: Provide components, which are listed and labeled by UL under the following standards.
   1. UL Std. 44 Rubber Insulated Wires and Cables
   2. UL Std. 83 Thermoplastic-Insulated Wires and Cables
   3. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
   4. UL Std. 854 Service Entrance Cable
D. NEMA/ICEA Compliance: Provide components which comply with the following standards:
   1. WC-5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
   2. WC-7: Cross Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
E. IEEE Compliance: Provide components, which comply with the following standard.

1. Std. 82: Test procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 - PRODUCTS

2.1 WIRES AND CABLES 600 VOLT COPPER CONDUCTORS

A. General: Provide suitable wire and cable for the temperature, conditions and location where installed. All wires and cables shall be new and delivered to the site in unbroken packages and reels.

B. All wires and cables shall be of the same manufacturer throughout the entire project.

C. Conductors: Provide solid conductors for power and lighting circuits #12 AWG and smaller. Provide stranded conductors for #10 AWG and larger.

D. Conductor Material: All wires and cables shall be copper, single conductor rated at 600 volts, which conform to or exceed ICEA specifications and the following:

1. In sizes 1/0 AWG to 4/0: Cross-linked polyethylene insulation type XHHW-2 (75 - 90°C) or THWN.
2. In sizes 250 KCMIL and larger: Type XHHW-2 (75°C) or THWN.
3. In sizes 1 AWG and smaller: All conductors shall have heat/moisture resistant thermoplastic insulation type THWN (75°C) except as follows:
   a. Where conduit temperature will exceed 100°F, use type THHN (90°C).
   b. In 120 volt incandescent fixtures, type SF-2 or SFF-2 (150 - 200°C).
   c. In wireway of fluorescent lighting fixtures type THHN (90°C).

E. Grounding conductors: Shall be of the same type as its associated phase conductors.

F. All conductors shall be label with wire size, insulation rating, etc using an engraved process, computer scan on labels are not permitted.

G. Color Coding for phase identification in accordance with Table 1 in Part 3 herein.

H. Connectors for Conductors:

1. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

I. Splices and Taps:

1. No. 12 AWG and smaller - Connectors for solid conductors shall be solderless, screw-on, spring pressure cable type, 600 volt, 105°C with integral insulation and UL approved for aluminum and copper conductors. Connectors for stranded conductors shall be crimp-on type with integral insulating cover.
2. No. 10 AWG and larger - Hydraulically applied crimping sleeve or tap connector sized for the conductors. Insulate the hydraulically applied connector with 90-degree, 600-volt insulating cover provided by the connector manufacturer. Insulator materials and installation shall be approved for the specific application, location, voltage, and temperature and shall not have an insulation value less than the conductors being joined.

J. Aluminum conductors are prohibited.

K. The use of modular wiring systems is prohibited.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Use the following wiring methods as indicated:

1. Install all wire in raceway. Power and control wiring shall be installed in separate raceways.

3.2 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC.

B. Coordinate cable and wire installation with other Work.

C. Do not install more conductors in a raceway than indicated on the drawings. A maximum of three branch circuits are to be installed in any one conduit on a 3-phase, 4-wire system, unless specifically noted otherwise on the drawings. When more than three branch circuits are installed in a raceway, the conductor size shall be increased per code for derating. No two branch circuits of the same phase are to be installed in the same conduit, unless specifically noted otherwise on the drawings.

D. Minimum wire size shall be a No.12 AWG except for control or signal circuits, which may be No. 14 AWG.

E. Unless otherwise indicated on drawings, all wiring for branch circuits shall be a minimum No. 12 AWG in ¾” conduit, protected by 20 amperes circuit breakers. If distance from panel to first outlet is 75 feet or greater for 120 volt circuits, and 125 feet or greater for 277 volt circuits, No. 10 AWG shall be installed throughout the circuit, unless noted otherwise on the drawings.

F. Size of current carrying conductors, unless noted otherwise on drawings, shall be determined from Table 310-16 of the latest National Electric Code for the load served.

G. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

H. Use pulling means including: fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

I. Size of conduits, unless specifically shown, shall be determined from Appendix C of the latest National Electrical Code.
J. Keep conductor splice to minimum. All splices shall be made within junction boxes, wiring troughs and other enclosures as permitted by the National Electrical Code. Do not splice conductors in panelboards, safety switches, switchboards, motor control centers or motor control enclosures. Splices in conductors installed below grade will not be permitted, unless approved in writing by the Architect.

K. Install splice and tap connectors, which possess equivalent or better mechanical strength and insulation rather than conductors being spliced.

L. Use splice and tap connectors which are compatible with conductor material.

M. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

N. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturers’ published torque tightening values. Where manufacturers’ torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque values specified in UL 486A and UL 486B.

O. Parallel feeders shall be installed so that all runs are of identical equal lengths.

P. Length of conductors at receptacles, junction switches at least 6" of free conductor shall be left at each outlet, junction and switches for splices or connection of fixtures or devices.

3.3 FIELD QUALITY CONTROL

A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.

B. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

D. Prior to completion of project, an infrared scan of switchgear and panelboard feeder equipment connection shall be performed when all loads are energized.

E. TABLE I: Color Coding for Phase Identification:

1. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

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<tr>
<th>208V/120 Volts</th>
<th>Phase</th>
<th>480V/277 Volts</th>
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<tr>
<td>Black</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
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<tr>
<td>White</td>
<td>Neutral</td>
<td>Gray</td>
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<tr>
<td>Green</td>
<td>Ground</td>
<td>Green</td>
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</tbody>
</table>
3.4 FEEDER TESTING

A. Products

1. Material: Contractor shall provide all necessary testing equipment and devices required to perform the test described in this section.

B. Execution

1. Visual and Mechanical Inspection
   a. Inspect cables for physical damage and proper connection in accordance with one-line diagrams.
   b. Test cable mechanical connections to manufacturer’s recommended values using a calibrated torque wrench.
   c. Check cable color coding with specification section 26 05 53 and National Electrical Code standards.

2. Electrical Tests
   a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
   b. Perform continuity test to insure proper cable connection.

3. Test Values
   a. Evaluate results by comparison with cables of same length and type. Investigate any values less than 50 megohms.
   b. Submit results to Engineer for approval in accordance with Section 26 05 03.

END OF SECTION 260519
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. Division-26 Basic Materials and Methods sections apply to work of this section.

C. Requirements of this section apply to electrical grounding and bonding work specified elsewhere in these specifications.

1.2 SUMMARY

A. Extent of electrical grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Type of electrical grounding and bonding work specified in this section includes the following:

1. Solidly grounded.

C. Applications of electrical grounding and bonding work in this section includes the following:

1. Building frames - structural steel.
2. Electrical power systems.
3. Grounding electrodes.
4. Separately derived systems.
5. Raceways.
6. Service equipment.
7. Enclosures.
8. Equipment.

D. Refer to other Division-26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s data on grounding and bonding products and associated accessories.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers whose products have been in satisfactory use in similar service for not less than 5 years.
B. Installer's Qualifications: Firms with at least 5 years of successful installation experience on projects with electrical grounding work similar to that required for project.

C. Codes and Standards:
   1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.
   2. UL Compliance: Comply with applicable requirements of UL Standards No.’s 467, Electrical Grounding and Bonding Equipment”, and 869 ”Electrical Service Equipment”, pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std 486A, ”Wire Connectors and soldering Lugs for Use with Copper Conductors.” Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
   3. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Materials and Components:
      1. Provide electrical grounding and bonding system; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is installer’s option. Where materials or components are not indicated provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

2.2 CONDUCTORS
   A. Insulated Conductors: Copper wire or cable insulated for 600V unless otherwise required by applicable Code or authorities having jurisdiction.
   B. Bare Copper Conductors:
      4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductors, 1/4 inch (6 mm) in diameter.
      5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductors.
      6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
      7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
   C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
      1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper (1/4 by 3 inches in cross section, unless otherwise indicated; with insulators. Main ground bus bar shall be 24 inches wide. Riser electrical ground bars shall be 12 inches wide.

2.3 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by Cadweld (or approved equal) manufacturer for materials being joined and installation conditions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
   1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
   2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 – EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No.10 AWG and smaller, and stranded conductors for No.8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned copper conductor, No.3/0 AWG minimum.
   1. Bury at least 24 inches (600 mm) below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits. The conduit shall not be acceptable as an equipment ground.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal in addition to the equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-3-by-12-inch (6-by-76-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.5 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

A. General: Install electrical grounding and bonding systems in accordance with manufacturer’s instructions and applicable portions of NEC, NECA’s “Standard of Installation”, and in accordance with recognized industry practices to ensure that products comply with requirements.
B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment
   3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, each unit substation, or each main electrical room grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer’s published torque tightening values for connectors and bolts. Where manufacturer’s torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
J. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

K. Install all connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

L. Ground each separately – derived system neutral to:
   1. Separate grounding electrode.
   2. Building steel and cold water pipe of area served.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.
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 26 Sections apply to this section:

1. "Electrical Requirements."

1.2 SUMMARY

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

B. Related Sections: The following Sections contain requirements that related to this Section:

1. Division 3 Section "Mild Steel Concrete Reinforcement" for inserts, anchors, and sleeves to be installed in concrete for use with supporting devices.
2. Division 5 Section "Metal Fabrications" for requirements for miscellaneous metal items involved in supports and fastenings.
3. Division 7 Section "Firestopping" for requirements for firestopping at sleeves through walls and floors that are fire barriers.
4. Refer to Division 26 Sections for additional specific support requirements that may be applicable to specific items.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

1. Hanger and support schedule showing manufacturer’s figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

C. Shop drawings indicating details of fabricated products and materials.

D. Engineered Design consisting of details and engineering analysis for supports for the following items:

1. Conduit (racked).
2. Ceiling mounted boxes, transformers.
3. Conduit - Ceiling mounted.
1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 “National Electrical Code.”

B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

C. Installation shall comply with local authorities seismic requirements.

PART 2 - PRODUCTS

2.1 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.2 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: All steel springhead type.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

F. Plastic or fiber anchors are prohibited.

2.3 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer’s recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
   3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
   5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use ¼-inch diameter or larger threaded steel. Use spring fasteners that are specifically designed for supporting single conduits or tubing.
   6. Space supports for raceway in accordance with NEC.
   7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, supports at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples of threadless box connectors.
   8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
   9. Attaching to ceiling support wires, mechanical piping, ductwork or plumbing piping is prohibited.

D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to the raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

F. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and wall for raceways and cable installations. For sleeves through fire-rated wall or floor construction, apply UL-listed
firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with "Fire Stopping" requirement of Division 7.

G. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions or light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than ¾ inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

I. TESTS: Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:

1. Expansion anchors.
2. Toggle bolts.

J. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer’s approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

END OF SECTION 260529
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 26 Sections apply to this Section:
   1. Division 26 Section “Electrical Requirements.”
   2. Division 26 Section “Basic Material and Methods”
   3. Division 7 Section “Firestopping” for requirements for firestopping at sleeves through walls and floors that are fire barriers.

1.2 SUMMARY

A. Drawings are diagrammatic. All bends, boxes, fittings, couplings are not necessarily shown. Supply as necessary to comply with the National Electric Code.

B. This Section includes raceways for electrical wiring. Types of raceways, boxes and fittings in this section include the following:
   1. Electrical metallic tubing (EMT).
   2. Flexible metal conduit.
   3. Intermediate metal conduit (IMC).
   4. Liquid-tight flexible conduit.
   5. Rigid metallic conduit (RMC).
   7. Rigid non-metallic conduit.
   8. Electrical non-metallic tubing (ENT)
   9. Wireway.
   10. Outlet boxes.
   12. Pull boxes.
   14. Locknuts.
   15. Knockout closures.

C. Related Sections: The following section contains requirements that relate to this section:
   1. Division 26 Section “Raceway and Boxes” for conduit connectors, fittings, and couplings.
   2. Division 7 Section “Firestopping” for conduit penetrations through rated walls and slabs.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of contract and Division 1 Specification Section.

B. Product Data for the following products:
   1. Raceways and fittings.
2. Wireways and fittings.
3. Boxes and fittings.

C. Installation Instructions: Manufacturer’s written installation instructions for wireway, surface raceway, and nonmetallic raceway products.

D. Product data and material safety data sheets (MSDS) for sealants used on the interior of the building indicating chemical composition and VOC content of each product used.

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 “National Electrical Code.”

B. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

C. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL.

D. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

E. Installer’s Qualifications: Firms with at least five years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.

F. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

G. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.

H. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.’s OS1, OS2 and PUB 250 pertaining to outlet and device boxes, covers and box supports.

I. Federal Specification Compliance: Comply with applicable requirements of FS W-C 586, “Electrical Cast Metal Conduit Outlet Boxes, Bodies, and Entrance Caps.”

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1

B. Intermediate Steel Conduit: UL 1242.

C. Electrical Metallic Tubing and Fittings: ANSI C80.3.

D. Flexible Metal Conduit: UL 1, zinc-coated steel.
E. Liquid-tight Flexible Metal Conduit and Fittings: UL 360.

2.2 METAL CLAD CABLE, TYPE MC

A. MC Cable is prohibited.

2.3 NONMETALLIC CONDUIT AND DUCTS

A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.

B. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

C. Conduit, Tubing and Duct Accessories: Types, sizes and materials complying with manufacturer’s published product information. Mate and match accessories with raceway.

D. Electrical non-metallic tubing (ENT): NEMA TC13 and UL1653.

2.4 CONDUIT BODIES AND FITTINGS

A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.

B. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.

C. EMT Conduit Bodies: Use bodies with steel set screw connectors and couplings for interior applications and steel compression gland connectors and couplings for vivarium area and exterior applications.

D. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL514B.

E. Liquid-Tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon or equal plastic compression ring, and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without O-ring seal. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit or other equipment to which it is connected.

F. Bushings: Insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC and EMT, larger than ¾" size.

G. Expansion Fittings: Each conduit that is buried in or secured to the buildings construction on opposite sides of a building expansion joint and each long run of exposed conduit that may be subject to excessive stresses shall be provided with an expansion fitting. Expansion fittings for rigid steel conduit shall be hot-dipped galvanized malleable iron with factory installed packing and a grounding ring. Expansion fittings for rigid non-metallic conduit shall be of the short type in runs 25’ or less, and the long type in runs 26’ to 80’. The long type shall be a two piece barrel and piston joint, providing 6” of the total movement range in ¾” through 6” conduit sizes. The short type shall be a one piece, coupling with O-ring, providing 2” of total movement range in ¾” to 2” conduit sizes.
H. Seal Off Fittings: Threaded, zinc or cadmium coated, cast or malleable iron type for steel conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

2.5 WIREWAYS

A. General: Electrical wireways shall be of NEMA types and sizes as indicated. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for complete system. Where features are not indicated, select to fulfill wiring requirements and comply with applicable provisions of NEC.

B. Wireway covers shall be hinged type.

2.6 FABRICATED MATERIALS - BOXES

A. Outlet Boxes: Provide galvanized flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes (minimum 4 inch square, 1 ½ inch deep), including box depths as required, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

1. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer’s code-compliance option.

B. Device Boxes: Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes (minimum 4 inch square, 1 ½ inches deep), including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with conduit-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide conduit connectors and corrosion-resistant screws for equipment type grounding.

1. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster ears, and plasterboard expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer’s code-compliance option.

C. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.

D. Junction and Pull Boxes: Provide galvanized code-gauge 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. Pull boxes installed in finished spaces must be flush mounted cabinets provided with trim, hinged door and flush latch and lock to match flush mounted panelboard trim.
E. Exterior junction or pull boxes, flush with grade:
   1. Exterior junction or pull boxes are not permitted without written approval from UCB Facilities Engineer.

F. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

2.7 VOC CONTENT

A. Sealants used on the interior building shall comply with VOC limits as seen in section 01 81 13 – Sustainable Design Requirements.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Outdoors: Use the following wiring methods:
   5. Connection to Vibrating Equipment including transformers, pneumatic or electrical solenoid, and motor-operated equipment: Liquid-tight flexible metal conduit.

B. Indoors: Use the following wiring methods:
   1. Exposed (below 10 ft. to floor): Intermediate metal conduit, rigid steel conduit.
   2. Exposed (above 10 ft. or in electrical room): Electrical metallic tubing.
   4. Connection to Vibrating Equipment including transformers, pneumatic or electrical solenoid, and motor-operated equipment: Flexible metal conduit.
   5. Connection to Vibrating Equipment in Moist/Humid or Corrosive Atmosphere including pneumatic or electric solenoid, and motor-operated equipment: Liquid-tight flexible metal conduit.
   6. Raceway mounted to underside of metal-corrugated sheet roof decking shall be Rigid Metal Conduit or intermediate Metal Conduit.

3.2 INSTALLATION OF RACEWAYS

A. General: Install electrical raceways in accordance with manufacturers’ written installation instructions, applicable requirements of NEC, and as follows.

B. For all power receptacle circuits and lighting circuits, the minimum conduit size shall be ¾”.

C. Conceal conduit and EMT, unless indicated otherwise, within finished wall, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations.
D. Elevation of Raceway: Where possible, install horizontal raceway runs above water and steam piping.

E. Complete installation of electrical raceways before starting installation of conductors within raceways.

F. Provide supports for raceways as specified elsewhere in Division 26 and in accordance with NEC and local authorities seismic requirements.

G. Prevent foreign matter from entering raceways by using temporary closure protection.

H. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab. All elbow penetration through the slab shall be PVC coated rigid metallic conduit Ells.

I. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

J. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.

L. Raceways embedded in slabs shall only be permitted with the strict written approval of the Structural Engineer and Architect. For bidding purpose, conduit shall not be permitted in slab.

M. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. All exposed conduit runs shall be approved by the Architect prior to installing.

N. All exposed conduits in public areas shall be painted to match surrounding walls. Verify exact color with the Architect. Painting specified herein shall be provided by others.

O. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways. All exposed conduit routing shall be approved by the Architect prior to installing.

P. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Use expansion fittings at building expansion joints.

Q. Tighten set screws of threadless fittings with suitable tool.

R. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside of the box. All conduit connections to junction boxes shall have insulated bushings.
S. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

T. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave no less than 12 inches of slack at each end of the pull wire.

U. Install raceway sealing fittings in accordance with the manufacturer’s written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces, air-conditioned spaces and walk-in coolers.
2. Where required by the NEC.

V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver-operated threaded flush plugs flush with floor.

W. Flexible connection: Use length (maximum of 6 ft.) of flexible conduit for recessed and semi-recessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid-tight flexible conduit in wet locations. Install separate equipment grounding conductor across flexible connections.

X. Install nonferrous conduit or tubing for circuits operating above 60 Hz.

Y. PVC externally coated rigid steel conduit: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.

Z. All underground conduits shall be installed a minimum of 48 inches below finish grade for medium voltage feeders and 30 inches for 480 volt feeders. All other conduits shall be installed in accordance with the NEC and coordinated depth with other trades.

AA. Grounding: Install a separate green equipment grounding conductor in all raceways from the panelboard/junction box supplying the raceway to the receptacle or equipment ground terminals. Conduits will not be permitted as a ground conductor.

3.3 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. General: Install electrical boxes and fittings in accordance 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. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide raintight “in use” outlets for interior and exterior locations exposed to weather or moisture.
D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Installing boxes back-to-back in walls shall not be permitted. Provide no less than 12 inches (150 mm) of separation.

G. Position recessed outlet boxes accurately to allow for surface finish thickness.

H. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surfaces.

I. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embedded electrical boxes in concrete or masonry.

J. Provide electrical connections for installed boxes.

K. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.4 GROUNDING

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

3.5 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

END OF SECTION 260533
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Requirements of the following Division 26 Sections apply to this Section:

1. “Electrical Requirements.”

1.2 SUMMARY

A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:

1. Buried electrical line warnings.
2. Identification labeling for raceways, cables, and conductors.
3. Operational instruction signs.
4. Warning and caution signs.
5. Equipment labels and signs.

B. Related Sections: The following Sections contain requirements that relate to this Section;

1. Division 9 Section “Painting” for related identification requirements.
2. Division 26 Section “Electrical Power Conductors and Cables” for requirements for color coding of conductors for phase identification.

C. Refer to other Division 26 Sections for additional specific electrical identification associated with specific items.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Schedule of identification nomenclature to be used for identification signs and labels.

D. Samples of engraved, plastic laminate to be used on switchgear, switchboards, disconnect switches and panelboards.

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 “National Electrical Code.”

B. ANSI Compliance: Comply with requirements of ANSI Standard A13.1, “Scheme for the identification of Piping Systems,” with regard to type and size of lettering for raceway and cable labels.
PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION PRODUCTS

A. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mil thick by 1 inch to 2 inches in width.

B. Underground Line Marking Tape: Permanent, bright-colored, continuous-printed, plastic tape with magnetic tracer strip not less than 6 inches wide by 4 mil thick. Printed legend indicative of general type of underground line below.

C. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wrap around, cable/conductor markers with preprinted numbers and letters.

D. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for sign up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in black letters on white face for normal power and red letters on white face for emergency and standby power. Plastic laminate shall be punched for mechanical fasteners.

E. Baked-Enamel Warning and Caution Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.

F. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, non-fading, preprinted cellulose acetate butyrate signs with 20-gage, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide ¼-inch grommets in corners for mounting.

G. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

H. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50°F to 350°F. Provide ties in specified colors when used for color coding.

I. Electronic Labels: Self-adhesive, 3/16 inch industrial label, black on clear for normal circuits and red on clear for emergency/standby circuits. Acceptable manufacturers include the following:

   1. Kroy
   2. Brother

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

1. Degrease and clean surfaces to receive nameplates and labels.
2. Install nameplates parallel to equipment lines.
3. Secure nameplates to equipment using screws or rivets. Locate nameplates on outside face of panelboard doors in finished locations.

C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

3.2 CONDUIT IDENTIFICATION

A. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels at concealed boxes.

B. Underground Electrical Line Identification: During trench backfilling, for underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches; install a single line marker.

C. Install line marker for underground wiring, both direct-buried and in raceway.

D. Identify Raceways of Certain Systems with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be painted with colors indicated below. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Apply the following colors:

2. Emergency Circuitry: Yellow.
4. Mechanical and Electrical Supervisory System: Green and Blue.
5. Telephone System: Green.
8. Television: Violet.
9. Tag or label conductors as follows:
   a. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and intent.
   b. Multiple Circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure label each conductor or cable. Provide label on each box indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
c. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facilities' electrical installations.

E. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

F. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

<table>
<thead>
<tr>
<th>208/120 Volts</th>
<th>Phase</th>
<th>480/277 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>Red</td>
<td>B</td>
<td>Orange</td>
</tr>
<tr>
<td>Blue</td>
<td>C</td>
<td>Yellow</td>
</tr>
<tr>
<td>White</td>
<td>Neutral</td>
<td>Gray</td>
</tr>
<tr>
<td>Green</td>
<td>Ground</td>
<td>Green</td>
</tr>
</tbody>
</table>

G. Use conductors with color factory-applied the entire length of the conductors except as follows:

1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG:
   a. Apply colored, pressure-sensitive plastic tap in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
   b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

2. All grounded conductors No. 6 AWG and smaller shall be a factory applied color across the entire length of conductors.

H. Power Circuit Identification:

1. Securely fasten wrap-around marker bands to cables, feeders, and power circuits in pull boxes, junction boxes, and switchgear rooms.

I. Apply warning, caution, and instruction signs and stencils as follows:

1. Install warning, caution, or instruction signs where required by NEC where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

2. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
J. Install equipment/system circuit/device identification as follows:

1. Apply equipment identification labels of engraved plastic-laminate on each major unit for electrical equipment in the facility including central or master unit of each electrical system. This includes communication/signal/alarm system, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 3/8-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), black lettering in white field for normal power and red lettering on white field for emergency and standby power. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment:

   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Electrical switchgear and switchboards.
   d. Motor starters...
   e. Pushbutton stations.
   f. Power transfer equipment.
   g. Contactors.
   h. Remote-controlled switches.
   i. Dimmers.
   j. Control devices.
   k. Transformers.
   l. Power generating units.
   m. Telephone switching equipment.
   n. Fire alarm master station or control panel.
   o. Lighting control panel.
   p. Static uninterruptable power supply

2. Apply electronic label on the outside of all receptacle and switch plates. The labels shall identify circuit and panelboard.

K. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification (including room numbers) of items controlled by each individual breaker.

END OF SECTION 260553
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 26 Sections apply to this section.

1.2 SUMMARY
   A. This Section includes the following:
      1. Receptacles
      2. Ground Fault Circuit Interrupter Receptacles
      3. Plugs
      4. Plug Connectors
      5. Snap Switches
      6. Wall Plates
      7. Occupancy Sensors
   B. Related Sections: The following sections contain requirements that relate to this section:
      1. Division 26 Section “Motor Disconnects and Fuses” for devices other than snap switches and plug/receptacle sets used as disconnects for motors.

1.3 SUBMITTALS
   A. Product data for each type of product specified.
   B. Occupancy Sensors
      1. Submit a lighting plan clearly marked by manufacturer identifying product type, locations, orientation and coverage for each sensor.
      2. Submit any interconnection diagrams per major subsystems showing proper wiring.

1.4 QUALITY ASSURANCE
   A. Regulatory Requirements: Comply with provisions of the following codes.
      1. NFPA 70 “National Electrical Code.”
   B. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL, Federal Specification and comply with applicable UL and NEMA standards.

1.5 SEQUENCE AND SCHEDULING
   A. Schedule installation of finish plates after the surface upon which they are installed has received final finish.
PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards.

B. Color of Devices: Color of all devices shall match existing, except special purpose devices shall be black, emergency power system devices which shall be red or isolated ground devices which shall be orange.

C. Receptacles: As scheduled in Table 1 in Part 3 indicated herein. Comply with UL 498 and NEMA WD 1 and WD 6.

D. Receptacles, Industrial Heavy Duty: Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Provide features indicated.

E. Ground-Fault Interrupter (GFI) Receptacles: As scheduled in Table 1 in Part 3 indicated herein: Provide “terminal” or feed-through type ground-fault circuit interrupter, as indicated on drawings, with integral heavy-duty NEMA 5-20R duplex receptacles. Provide unit designed for installation in a 2-3/4-inch deep outlet box without adapter, grounding type, Class A, Group 1 per UL Standard 943.

F. Snap Switches: As scheduled in Table 2 in Part 3 indicated herein.

G. Wall Dimmer: As scheduled in Table 2 in Part 3 indicated herein.

1. Incandescent wall dimmers shall be 120 volt, solid state type with slide control handle, preset button and semi-flush mounting. Dimmers shall be sized to continuously carry the load they are connected to, the minimum size shall be 1000 watts, and shall be rated larger if indicated on the drawings or required to serve the load.

2. Dimmers indicated on the drawings to serve low voltage incandescent lamps shall be the same as specified for incandescent lamps and in addition shall be specifically rated for the low voltage transformer load. Dimmer shall be UL listed for use with low voltage fixtures.

3. Dimmers indicated to serve fluorescent lamps shall be 120v or 277v, as required for circuit served, solid state type for use with fluorescent dimming ballasts. Control shall be slide handle and dimmer shall be for semi-flush mounting.

4. All dimmers shall be of the same manufacturer. Faceplate shall be the same color as device plates specified.

H. All exterior weatherproof receptacles located on the roof, receptacles located in elevator pits and machine rooms shall be GFI type or GFI protected and have “in use” covers.

I. All devices shall be premium specification grade.
2.2 WIRING DEVICE ACCESSORIES

A. Wall Plates: Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates with engraved legend where indicated on drawings. Engraving shall be done by the device manufacturer. All lettering shall be 1/8-inch high and shall be black for normal power systems and red for emergency power systems. Provide plates possessing the following additional construction features:

1. Material and Finish: 0.04 inch thick, type 302 satin finished stainless steel. Plate shall be Hubbell "S" Series or approved equal.

B. For all devices installed which are exposed to the weather, moisture or where indicated on the drawings, device plates shall be weatherproof. Device plates shall be cast type with gasketing to prevent entrance of moisture when closed.

2.3 OCCUPANCY SENSORS

A. General: Layouts shown on plan drawings are intended to show general control concepts (i.e. wall sensors, ceiling sensors, or switch sensor) for an area. The contractor shall provide sensor coverage of the entire space based on the concept shown, as well as all other devices required (power packs, control wiring, switching, etc.) for a complete and working system. Low voltage switching to allow local override of the sensors shall be provided at all entries to areas shown as controlled by ceiling or wall mounted sensors. In areas that require two or more sensors for full coverage, the sensors shall be interconnected together to provide a single switching zone for the entire space, regardless of the number of circuits.

B. Occupancy sensor shall be Watt Stopper SDRAWSEN/SCOMSEN. Refer to section 26 05 05 for additional acceptable manufactures.

C. Wall switch sensor shall be capable of detection of occupancy up to 300 square feet and gross motion up to 1000 square feet. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts, 0 to 1200 watts at 277 volts and shall have 180° coverage capability. All wall switch shall utilize zero crossing circuitry, field delectable option (automatic – on to manual on).

D. Ceiling mounted sensors shall be dual technology (passive infrared and ultrasonic). The sensor shall offer day lighting foot candle adjustment control and be able to accommodate dual level lighting. Sensors shall be immune to false triggering from RFI and EMI.

E. All sensors shall utilize automatically adjustable time delay and sensitivity settings. Settings shall be located on sensor.

F. In the event of failure, a bypass override shall be provide on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall diver to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

G. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both test and normal operation.

H. Sensors shall have an internal additional isolated relay with normally open, normally closed and common outputs for use with HVAC control, data logging and other control options.
2.4 POKE-THROUGH FLOOR BOXES

A. Modular Furniture Feed Low Voltage Fire Rated Poke-Through

1. Poke Through: Poke Through shall be manufactured with high strength cast aluminum construction, designed to fit in 3-inch core hole opening.
   a. Fire Rating: Poke Through shall be UL listed for use in 2 hour fire rated floors, as a minimum.
   b. Poke Through shall have adjustable lower fire barrier to accommodate various floor thicknesses.

2. Conduit Openings: Poke Through shall have through floor fitting with a minimum of (1) 2-inch conduit.

3. Cover: Poke Through cover shall be manufactured with high strength cast aluminum construction and shall be available with a 2-inch knock-out. Exact cover finish for each specific location shall be coordinated with the Owner, Architect and Engineer during the submittal process, prior to purchase and installation, to ensure the desired aesthetics are achieved. At a minimum, device cover shall be available in the following finish options for both the carpet and tile flange assemblies:
   a. Brass
   b. Aluminum
   c. Black
   d. Gray

4. Flexible Conduit Feed: Black 2-inch Polytuff flexible conduit shall be provided to extend low voltage device cabling from floor box knock-out to modular furniture.

5. Products:
   a. Poke Through: Hubbell System One #PT2FIT or approved equal.
   b. Cover: Hubbell #FF2xxx (xxx=finish) or approved equal.

B. Modular Furniture Feed Power Fire Rated Poke-Through

1. Poke Through: Poke Through shall be manufactured with high strength cast aluminum construction, designed to fit in 3-inch core hole opening.
   a. Fire Rating: Poke Through shall be UL listed for use in 2 hour fire rated floors, as a minimum.
   b. Poke Through shall have adjustable lower fire barrier to accommodate various floor thicknesses.

2. Conduit Openings: Poke Through shall have through floor fitting with a minimum of (1) 3/4-inch conduit.

3. Cover: Floor box cover shall be manufactured with high strength cast aluminum construction and shall be available with a minimum of (1) 3/4-inch knock-out. Exact cover finish for each specific location shall be coordinated with the Owner, Architect and Engineer during the submittal process, prior to purchase and installation, to ensure the desired aesthetics are achieved. At a minimum, device cover shall be available in the following finish options for both the carpet and tile flange assemblies:
   a. Brass
   b. Aluminum
   c. Black
d. Gray

4. Power Entry Cable: Power entry cable to be provided with modular furniture system.

5. Products:
   a. Poke Through: Hubbell System One #PT71SD or approved equal.
   b. Cover: Hubbell #FRF1xxx (xxx=finish) or approved equal.

C. Combination Fire Rated Poke-Through (Power and Low Voltage)

1. Poke Through: Poke Through shall be manufactured with high strength cast aluminum construction, designed to fit in 4-inch core hole opening.
   a. Fire Rating: Poke Through shall be UL listed for use in 2 hour fire rated floors, as a minimum.
   b. Poke Through shall have adjustable lower fire barrier to accommodate various floor thicknesses.
   c. Poke Through shall have step down installation clips to allow fitting to be installed or removed from the floor where the device outlets are located.

2. Device Channels: Poke Through shall have dual channel through floor fitting to accommodate power and low voltage cabling and outlets.

3. Conduit Openings: Poke Through shall have a minimum of (1) 1-inch conduit for each channel.

4. Cover: Poke Through cover shall be manufactured with high strength cast aluminum construction and shall be available in either universal carpet or tile flange with cover assembly. Exact cover type and finish for each specific location shall be coordinated with the Owner, Architect and Engineer during the submittal process, prior to purchase and installation, to ensure the desired aesthetics are achieved. Device cover shall be available in the following finish options for both the carpet and tile flange assemblies:
   a. Brass
   b. Aluminum
   c. Black
   d. Gray

5. Sub-Plate: Poke Through sub-plate shall have (2) Style Line openings to allow for ultimate flexibility of a 4-plex power receptacle or combination duplex power receptacle and low voltage device outlets as indicated on drawings.

6. Low-Voltage Style Line Outlet Frames: Coordinate with cabling contractor for mounting plate requirements.

7. Products:
   a. Poke Through: Hubbell System One #S1PTFIT or approved equal.
   b. Carpet Cover: Hubbell #S1CFCxxx (xxx = finish) or approved equal.
   c. Tile Cover: Hubbell # S1TFCxxx (xxx = finish) or approved equal.
   d. Sub-Plate: Hubbell #S1SP or approved equal.
PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work.

C. The mounting height of devices is indicated in the legend on the drawings. Where finished walls are exposed concrete block, brick or tile, the height shall be adjusted to allow outlet box for device to be mounted at a joint.

D. Receptacles above countertops shall be installed with major axis horizontal above the backsplash with neutral side up.

E. Mount all devices within outlet boxes to allow device plates to be in contact with wall on all sides. Align devices with major axis of device parallel to adjacent predominant building feature, i.e., door frames or countertops.

F. Install wall switches on the strike side of doors.

G. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.

H. Provide a current carrying conductor, neutral, equipment grounding conductor and an insulated grounding conductor to each isolated ground “IG” receptacle.

I. Install galvanized steel wall plates in unfinished spaces.

J. Install wiring devices after wiring work is completed.

K. Install wall plates after painting work is completed.

L. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values for wiring devices. Where manufacturer’s torque requirements are not indicated, tighten connectors and terminal to comply with tightening torque requirements specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

M. Provide circuit identification labels as required by Section 26 05 53.

3.2 PROTECTION

A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.3 FIELD QUALITY CONTROL

A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing test wiring
devices and demonstrating compliance with requirements, operate each operable device at least six times.

B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

C. TABLE 1

RECEPTACLES

<table>
<thead>
<tr>
<th>Designation (1)</th>
<th>Current Rating Amps</th>
<th>Voltage Rating</th>
<th>Single/Duplex</th>
<th>NEMA Config.</th>
<th>Hubbell Catalog #(3)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>20</td>
<td>125</td>
<td>Duplex</td>
<td>5-20R</td>
<td>HBL5362</td>
<td></td>
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<tr>
<td>-</td>
<td>20</td>
<td>125</td>
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<td>5-20R</td>
<td>HBL5361</td>
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<tr>
<td>IG</td>
<td>20</td>
<td>125</td>
<td>Duplex</td>
<td>5-20R</td>
<td>IG5362</td>
<td>Isolated Ground</td>
</tr>
<tr>
<td>WP</td>
<td>20</td>
<td>125</td>
<td>Duplex</td>
<td>5-20R</td>
<td>GF8300A/ WP26M(4)</td>
<td>In Use Weather-proof</td>
</tr>
<tr>
<td>GFI</td>
<td>20</td>
<td>125</td>
<td>Duplex</td>
<td>5-20R</td>
<td>GF8300A</td>
<td>Integral GFI</td>
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<tr>
<td>-</td>
<td>20</td>
<td>125</td>
<td>Duplex</td>
<td>5-20R</td>
<td>HBL5362SA</td>
<td>Surge Suppression</td>
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<tr>
<td>-</td>
<td>20</td>
<td>125</td>
<td>Duplex</td>
<td>5-20R</td>
<td>HBL8300SGA</td>
<td>Tamperproof</td>
</tr>
</tbody>
</table>

NOTES

1. Letter designations are used where symbols alone do not clearly designate on plans locations where specific receptacle types are used.
2. Protecting downstream receptacles on same circuit is not acceptable.
3. Refer to Section 26 05 05 for additional acceptable manufacturers. Color of device shall match existing. All emergency receptacles shall be red.
4. Where required per NEC or local code provide ‘RW57900’ in-use water-proof cover for two-gang devices.

D. TABLE 2

SNAP SWITCHES/WALL DIMMERS

<table>
<thead>
<tr>
<th>Designation (1)</th>
<th>Typical Application</th>
<th>Load Rating</th>
<th>Voltage Rating (AC)</th>
<th>Poles</th>
<th>Hubbell Catalog #(4)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Control Lights</td>
<td>20A</td>
<td>120/277</td>
<td>1</td>
<td>HBL1221</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>Control Lights</td>
<td>20A</td>
<td>120/277</td>
<td>3-way</td>
<td>HBL1223</td>
<td></td>
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<tr>
<td>S4</td>
<td>Control Lights</td>
<td>20A</td>
<td>120/277</td>
<td>4-way</td>
<td>HBL1224</td>
<td></td>
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<tr>
<td>Sp</td>
<td>Switch &amp; Pilot Light</td>
<td>20A</td>
<td>120</td>
<td>1</td>
<td>HBL1221PL</td>
<td>(2)</td>
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<tr>
<td>Sp</td>
<td>Switch &amp; Pilot Light</td>
<td>20A</td>
<td>277</td>
<td>1</td>
<td>HBL1221PL7</td>
<td>(2)</td>
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<tr>
<td>D</td>
<td>Dimmer Switch</td>
<td>1000W</td>
<td>120</td>
<td>1</td>
<td>Vareo Series w/preset</td>
<td>(3)</td>
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<tr>
<td>Sk</td>
<td>Key Switch</td>
<td>20A</td>
<td>120/277</td>
<td>1</td>
<td>HBL1221L</td>
<td></td>
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</tbody>
</table>
### NOTES

1. For snap switches, designation is the same as the symbol used on plans for the device. Type of switch is determined from plan context including type of device or circuit being controlled.
2. Pilot light “on” when switch is “on.”
3. Lutron dimmer (refer to 26 05 05 for additional manufacturers). Provide dimmer wattage size to handle load served. Derate dimmer switch per manufacturer’s recommendations where dimmers are ganged together. Provide dimmer model as required based on application, i.e., incandescent, magnetic low voltage, fluorescent magnetic ballast or fluorescent electronic ballast.
4. Refer to Section 26 05 05 for additional acceptable manufacturers. Color of device shall match existing.

END OF SECTION 262726
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. Division 26 Basic Electrical Materials and Methods sections, apply to work of this section.

1.2 SUMMARY

A. Provide all circuit and motor disconnect switch work including fusing, electrical connections to motors, appliance and mechanical equipment as indicated on the drawings and schedules.

B. Types of circuit and motor disconnect switches in this section include the following:
   1. Equipment disconnects.
   2. Appliance disconnects.

C. Applications of electrical power connections specified in this section include the following:
   1. To resistive heaters.
   2. From electrical source to motor starters.
   3. From motor starters to motors.
   4. To lighting fixtures.
   5. To converters, rectifiers, transformers, inverters, rheostats, and similar current adjustment features of equipment.
   6. To grounds including earthing connections.
   7. To panelboards, contactors, time clocks and similar equipment.

D. All switchboards, panelboards, disconnect switches, starters, etc., shall be fabricated by same manufacturer throughout the entire project.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s data on circuit and motor disconnect switches, and equipment connectors.

B. Fuse Product Data: For each type of fuse indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
   1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
      a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
      b. Provide manufacturer’s technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

1.4 QUALITY ASSURANCE

A. All equipment shall be in compliance with codes and standards referenced in Section 26 05 02 titled "Electrical Requirements".

B. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches." Provide circuit and motor disconnect switches which have been UL listed and labeled.

C. Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," including, but not limited to, tightening of electrical connectors to torque values indicated.

D. NEMA Compliance: Comply with applicable requirements for NEMA Stds Pub/No. KS 1, "Enclosed Switches," and No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

E. ANSI Compliance: Comply with applicable requirements of ANSI C97.1, "Low-Voltage Cartridge Fuses 600 Volts or Less."

F. NEMA Compliance: Comply with NEMA FU1 for cartridge fuses.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Furnish and install safety switches as required for motor outlets or other equipment. Switches shall be of size, number of poles, and fused or non-fused, as required for job conditions and the National Electrical Code.

B. Switches shall be equipped with fuse contacts and jaws which ensure positive fuse and jaw contact by means of reinforcing spring clips of other approved means. All current carrying parts shall be silver-plated. Hinges shall be non-current carrying. Switches shall be so designed that they can be locked in either open or closed position.

C. All safety switches shall be NEMA 1 enclosed Type "HD" (heavy duty) quick-make, quick-break, and have interlocking cover with handle that may either be front or side operating with padlocking provisions. Provide NEMA 3R weather proof enclosures where indicated on the drawings or exposed to exterior or damp locations. Incorporate rejection clips where used with Class "R" fuses.
D. Fusible Switches: Heavy duty switches, with fuses of classes and current ratings indicated on drawings. See Section “2.3” for Fuse specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

E. Non-fusible Disconnects: Heavy duty switches of classes and current ratings as indicated on drawings.

F. Double-Throw Switches: Heavy duty switches of classes and current rating as indicated on drawings.

G. Bolted Pressure Switches: Bolted pressure switches conforming to and listed under UL Standard 977; single or double-throw arrangement as indicated. For fusible units provide fuses as indicated on drawings.

H. Accessories:
   1. Electrical Interlocks: Provide (1) N.O. and (1) N.C. interlock contacts in all switches.
   2. Special Enclosure Material: Provide special enclosure material as follows for switches indicated on drawings to be NEMA 4X:
      a. Stainless Steel Type 316.
      b. Heavy case aluminum.

2.2 CONNECTIONS FOR EQUIPMENT

A. General: For each electrical connection indicated provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wirenuts. All other items and accessories as needed to complete splices and terminations of types indicated.

B. Metal Conduit, Tubing and Fittings:
   1. General: Provide metal conduit, tubing and fitting of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Section 26 05 06 titled “Basic Materials and Methods” and Section 26 05 33 titled “Raceways and Boxes” and in accordance with the following listing of metal conduit, tubing and fittings:
      a. Rigid steel conduit.
      b. Rigid metal conduit fittings.
      c. Electrical metallic tubing.
      d. EMT fittings.
      e. Flexible metal conduit.
      f. Flexible metal conduit fittings.
      g. Liquid-tight flexible metal conduit.
      h. Liquid tight flexible metal conduit fittings.
C. Wires, Cables, and Connectors:

1. General: Provide wires, cables and connectors complying with Division 26 05 06 titled “Basic Materials and Methods” and “Section 26 05 19” titled “Electrical Power Conductors and Cables.”

2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and rating, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended for use by equipment manufacturer for intended applications.

4. Electrical Connection Accessories: Provide electrical insulating tape, heat shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

2.3 FUSES

A. General: Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics, which comply with manufacturer’s standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations.

B. Class RK1 dual element time-delay fuses: Provide UL Class RK1 current limiting time-delay fuses rated 600-volts, (250 volts where specified), 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting circuit breakers, motors and panelboards.

C. Class RK5 dual element time-delay fuses: Provide UL Class RK5 current limiting time-delay fuses rated 600 volts, (250 volts where specified), 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting circuit breakers, motors, and transformers.

D. Class L time-delay fuses: Provide UL Class L time-delay fuses rated 600 volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating.

PART 3 - EXECUTION

3.1 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES

A. Install circuit and motor disconnect switches as indicated, complying with manufacturer’s written instructions, applicable requirements of NEC, NEMA, and NECA’s “Standard of Installation,” and in accordance with recognized industry practices.

B. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches for use with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

D. Provide control wiring as needed for motor disconnect to remote VFD controller.
3.2 INSTALLATION OF EQUIPMENT CONNECTIONS

A. Install electrical connections in accordance with equipment manufacturer’s written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA’s “Standard of installation” to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer’s written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires and terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid “nicking” copper conductors while skinning wire.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torque tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer’s torque requirements are not available, tighten connectors and terminals to comply with torque values contained in UL 486A.

H. Provide PVC-coated conduit and fittings for highly-corrosive atmospheres.

I. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.

J. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:

1. Exterior location.
2. Moist of humid atmosphere where condensation can be expected to accumulate.
3. Corrosive atmosphere.
5. Dripping oil, grease, or water.

K. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number in accordance with Division 26 section titled “Electrical Identification.” Affix markers on each terminal conductor, as close as possible to the point of connection.

L. Provide flexible metal conduit or Type “S” rubber cords, pigtails, caps, etc., as required to constitute an operating system. All flexible cords shall have a grounding conductors. Ground
all equipment. See Section 26 05 26 titled “Grounding and Bonding” for additional requirements.

M. Prior to roughing-in, refer to all equipment manufacturer’s shop drawings for details of equipment connections. Provide receptacles as required to match the cord caps on the equipment furnished. Provide either direct wiring or receptacles for final connection to equipment as required for the particular equipment furnished regardless of the type of outlet shown on the plans.

3.3 INSTALLATION OF FUSES

A. Install fuses as indicated, in accordance with manufacturer’s written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC, and NEMA standards for installation of fuses.

B. Coordinate work including electrical wiring, as necessary, to interface installation of fuses with other trades.

C. Install fuses in fused switches.

D. Provide spare fuse cabinet located in the main electrical room. Provide spare fuse of size and type for every five (5) fuses installed. A minimum of three (3) spare fuses shall be provided for each size installed.

3.4 GROUNDING

A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground for electrical disconnect switches.

3.5 FIELD QUALITY CONTROL

A. Testing: Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 262816
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. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

C. Refer to Appendix for Light Fixture Cutsheets

1.2 SUMMARY

A. Extent, Relative location, and details of lighting fixture work are indicated on drawings and in schedules. Refer to Architectural Reflected Ceiling (landscape Architect) Plans for precise fixture locations.

B. Types of lighting fixtures in this section include the following:
   2. Fluorescent.
   3. Light Emitting Diode, LED
   4. Other lamps as noted on fixture schedule.

C. Fixture: A complete lighting unit includes lamps, wiring, controls and parts required to securely support fixture.

D. Exact ceiling construction shall be verified and coordinated with fixture type and mounting prior to ordering. Minor changes in ceiling construction shall not be an extra cost to the project.
   1. All materials, accessories, and any other equipment necessary for the complete and proper installation of all lighting fixtures included in this Specification shall be furnished by the Contractor.
   2. Fixtures shall be manufactured in strict conformance with the Contract Drawings and Specifications.
   3. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary of the work.
   4. Minor details, not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fixtures, shall be included, the same as if they were herein specified or indicated on the drawings.
   5. The Owner shall not be held responsible for the omission or absence of any detail, construction feature, etc., which may be required in the production of the fixtures. The responsibility of accurately fabricating the fixtures to the fulfillment of this specification rests with the Contractor.

E. Where a catalog number and a narrative or pictorial description is provided, the written description shall take precedence and prevail.
F. General Contractor shall provide electrical subcontractor with entire lighting specification (including fixture cut sheets, illustrations and sketches); electrical subcontractor shall provide each specified manufacturer with complete information about the fixtures they will supply.

G. The contractor shall include the installation of an additional 20 exit signs in the base price for future request for exit signs by the Fire Department or Building Official.

H. Fixture details shown may be modified by the manufacturer provided all of the following conditions have been met:
   1. Fixture performance is equal or improved.
   2. Structural, mechanical, electrical, safety, and maintenance characteristics are equal or improved.
   3. Cost to the Owner is reduced or equal.
   4. Modifications have been reviewed by the Architect and have been approved by the Architect in writing.

1.3 SUBMITTALS

Submit shop drawings, samples, and prototypes as specifically instructed below.

A. Shop drawings shall include but not be limited to:
   1. For standard catalog items with no modifications, submit catalog cut sheets prepared by the manufacturer which clearly show all elements to be supplied and all corresponding product data (including lamping; ballast manufacturer and model number; voltage; accessories or options and any miscellaneous items detailed in the written description of the specification). If cut sheet shows more than one (1) fixture type, all non-applicable information shall be crossed out.
   2. For lamps, submit catalog cut sheets prepared by the manufacturer which clearly shows manufacturer, CRI, CT, wattage, base type, lumen output, lamp life, and any other pertinent information.
   3. For custom fixtures, modified fixtures or linear fluorescent fixtures mounted in continuous rows, submit a reproducible drawing prepared by the manufacturer showing all details of construction, lengths of runs, lamp layout, pendant locations, power locations, finishes and list of materials. Drawings must be to scale. Contractor shall provide manufacturer with field dimensions where required.
   4. For all submittals under paragraphs 1 through 3 above, manufacturer shall provide submittals within two weeks of receipt of order. All submittals shall have project name and fixture type clearly shown.
   5. The Architect/Engineer shall make the final determination as to whether or not the submittal contains sufficient information and reserves the right to request a shop drawing if the fixture cut is insufficient.
   6. Maintenance Data: Submit maintenance data and parts list for each lighting fixture, accessory and also include “trouble-shooting” maintenance guide. In addition to the product data and shop drawings, a maintenance manual in accordance with general requirements of Division 1 shall be provided.

B. Substitutions: Manufacturers or light fixtures not listed on fixture schedule must be prequalified prior to bid. This is demonstrated by an “Approved Alternate” listing in the manufacturer column. It in no way implies approval. For approval of all manufacturer/fixture substitutions, the
bidders shall comply to specifications herein and as outlined below for submitting alternate fixtures:

1. No substitutions shall be accepted when the LIGHT FIXTURE SCHEDULE includes a three name manufacturer specification.
2. Manufacturer shall have not less than five years experience in design and manufacture of lighting fixtures of the type and quality shown. Prequalification submissions must include a list of completed projects and data catalogue pages and drawings indicating length of experience.
3. Bidders wishing to obtain approval on brands other than those specified by name and catalog number or as an approved alternate in LIGHTING FIXTURE SCHEDULE shall submit their requests not later than fifteen (15) business days before the bid opening. Approval will be in the form of an addendum to the specifications issued to all prospective bidders indicating that the additional brand or brands are approved, as equal to those specified as far as the requirements of the project are concerned.
4. If the bidders do not elect to obtain prior approval during the time so specified above, the Owner/Architect/Engineer or Lighting Designer has no obligation to review or consider any such article after the contract award.
5. Contractor shall pay professional fees at current standard hourly rates and reimburse expenses directly to all designers (Architect, Engineer and Lighting Designer) for time spent reviewing substitutions proposed by the Contractor after the bid has been awarded. If payment by the Contractor is not made within 60 days of invoice date, the Owner shall deduct the amount due from subsequent payments to the Contractor in order to reimburse designers.
6. Request for approval shall be accompanied by working fixture samples (with an appropriate lamp, complete photometric, mechanical and electrical data, list of materials and finishes and unit cost to the Owner) of both the specified brand and the proposed substitutes as required to make complete comparison and evaluation. These samples shall be in addition to those required by Lighting Fixture Specification. The above data shall be delivered separately to the Architect and the Engineer. The fixture samples shall be furnished and installed at the bidder’s expense, at a location selected by the Architect. In addition, the bidder shall furnish the Architect and the Engineer with the name and location of at least one completed project where each proposed substitute has been in operation for a period of at least six (6) months, as well as the names and addresses of the Owner, the Architect and the Engineer.
7. Point by point lighting calculations of areas affected by proposed substitution will be done by the bidder for review.
8. The Architect and Engineer shall determine whether the prototype sample complies with the specifications and shall reserve the right to disqualify any bidders.
9. When required and requested by the Architect, or Engineer, samples submitted as per above shall be subjected to photometric, thermal, mechanical, electrical or water testing at an independent test laboratory at no expense to the Owner.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of lighting fixtures of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer’s Qualifications: Firms with at least 5 years of successful installation experience on projects with lighting fixture work similar to that required for this project.
C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 220, 225, 250, 410, and 500 as applicable to installation and construction of building lighting fixtures.

2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No’s LE 1 and LE 2 pertaining to lighting equipment.

3. IES Compliance: Comply with IES RP-1 pertaining to office lighting practices and RP-15, regarding selection of illuminance values for interior office lighting. Comply with IES RP-8, 19, 20, and PB-15 pertaining to exterior, parking, and roadway lighting practices and fixtures.

4. UL Compliance: Comply with UL standards, including UL 486A and 486B, pertaining to lighting fixtures. Provide lighting fixtures and components which are UL-listed and labeled.

5. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturer’s Association standards and carry the CBM label.

D. Special Listing and Labeling: Provide fixture for damp locations, wet locations, recessed in rated ceilings and walls, hazardous that are UL listed and labeled for specific use.

E. Materials and Equipment:

1. Materials, equipment, and appurtenances as well as workmanship provided under this Section shall conform to the highest commercial standards, and as specified and as indicated on drawings. Fixture parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion and thermal and mechanical stresses encountered in the normal application and function of the fixtures.

2. All fixtures shall be manufactured to a consistent level of quality. Size, color, and component parts shall be identical for all fixtures of the same type.

1.5 DELIVERY, STORAGE, HANDLING, AND WARRANTY

A. Deliver lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.

B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperature, humidity, laid flat and blocking off ground.

C. Handle lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

D. Provide a 5-year warranty of failure in materials, workmanship, ballast, etc., in addition to and not limited to other rights the Owner may have under the contract documents. A full warranty shall apply for the first year, and a prorated warranty for the last four years.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways to properly interface installation of lighting fixtures with ceiling requirements.

B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The Contractor shall base bid for lighting fixtures on the manufacturers listed on the fixture schedule only.

B. Alternate manufacturer’s identification by means of manufacturer’s names is to establish basic features and performance standards. Alternate manufacturer’s or substitutions must meet or exceed the standards of the primary manufacturer listed.

C. Qualifications: The contractor is allowed 60 days after the contract has been awarded to submit independent photometric tests and samples for all approved alternate fixtures. If these fixtures fail to comply with the specification requirements at that time, the Contractor will furnish acceptable fixtures at no additional cost to the Owner and with no delay to the project.

D. Any submittals for cost reduction alternates or value engineering shall include unit prices for the specified manufacturer, the specified equal manufacturer, and the proposed alternates. Refer to Part 1.3 for approval process.

2.2 MATERIALS AND FABRICATION

A. Provide thickness of metal required or as specified so that all fixture are rigid, stable and will resist deflection, twisting, warping or bending under normal installation procedures, loading, relamping, etc.

B. Provide neoprene or silicone gasketing, stops, and barriers where required to prevent light leak or water and water vapor (penetration).

C. Provide finished product with ground metal edges, tight fitting connections, hinges and closures; clean, neat edges, trims, and frames; continuous welds, ground smooth with sharp corners; all exposed screws countersunk flush.

D. Provide positive, durable means of connection at all joints as required.

E. All cast parts, including die-cast members, shall be of uniform quality, free from blow holes, pores, hard spots, shrinkage defects, cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.

F. Provide sufficient ventilation for lamps, ballasts and transformers including vent holes where required. Outdoor fixtures shall have corrosion resistant wire mesh screens in the vent holes.

G. All adjustable fixtures shall be provided with reliable locking device to secure aiming angles of the fixture housing or lamp yoke as well as lamp and lens orientation devices to secure oval beam pattern lamps and/or spread lenses.

2.3 FINISHES

A. Fixture finishes shall be applied in a manner that will assure a durable, wear resistant surface.

1. Prior to finishing, all surfaces shall be free from foreign materials such as dirt, rust, oil, polishing compounds and mold release agents.
2. Where necessary, surfaces shall be hot cleaned by accepted chemical means and shall receive corrosion inhibiting (phosphating) treatment assuring positive paint adhesion.
3. Provide all ferrous metal surfaces with a protective finish having rest-inhibiting properties. Painted finishes shall be a minimum of 1.5 mils thick and shall have a balance between hardness and bending properties suitable for application. White finishes shall have 87 percent minimum reflectance. Application and cleaning shall be performed so as to prevent any loss of reflectance capability.

2.4 WIRING

A. All wiring shall comply with the following:

1. All wiring devices within lighting fixtures or from the fixture to the splice with the project branch circuit wiring shall be as specified below.
2. Wiring between fluorescent lampholders and associated operating and starting equipment shall be of similar or heavier gauge than the leads furnished with the approved types of ballasts with equal or better insulating and heat resisting characteristics.
3. Wiring shall be protected with tape or tubing at all points where abrasion may occur.
4. Wiring shall be concealed within the fixture construction except where design or mounting dictates otherwise.
5. Connections of wires to terminals of lampholders and other accessories shall be made in a neat and workmanlike manner and electrically and mechanically secure with no protruding or loose strands. The number of wires extending to or from the terminals of a lampholder or other accessory shall not exceed the number which the accessory is designed to accommodate.
6. Joints in wiring within lighting fixtures and connections of the fixture wiring to the wiring of the building shall be specified in Division 26.
7. Wiring channels and wireways shall be free from projections and rough or sharp edges throughout, and all points or edges over which conductors must pass and may be subject to injury or wear shall be rounded and bushed.
8. Insulated bushings shall be installed at points of entrance and exit of flexible wiring.
9. Junction boxes attached to lighting fixtures shall be manufactured in accordance with the National Electrical Code and approved for the number of conductors indicated on the drawings. Supplementary junction boxes shall be installed where required to comply with Code.
10. When exposed, all junction boxes and conduit to be painted as per the Architects’ direction at no additional cost to the Owner.
11. Cord types shall be suitable for application and be fitted with proper strain relief and watertight entries where required by application.
12. Furnish code approved wiring in ceiling cavities forming air plenums.

2.5 MARKING OF FIXTURES

A. Fixtures designed for voltages other than 110-125 volts shall be marked with operating voltage.

B. Fixtures equipped for operation of rapid start lamps shall be clearly marked “USE RAPID START LAMPS ONLY.”

C. Fixtures designed for operation of lamps below the rated enclosure maximum shall be clearly marked “Lamp Watts Not to Exceed _______” to maintain the design energy load.
2.6 SOUND TRANSMISSION

Sound transmission through the light fixture units, when spaced as indicated on drawings, shall be sufficiently attenuated to maintain speech privacy between adjoining spaces. Contractor to provide insulating battens around the fixtures where sound transmission levels are unacceptable.

2.7 THERMAL PROTECTORS

A. Provide thermal protectors as required by the N.E.C., or as required by local Code, to prevent operation of lighting fixtures in enclosed spaces or adjacent to combustible materials at temperatures at or above 90°C (194°F).

B. Fixtures approved for operation in fire-resistant material at temperatures up to 150°C (302°F) shall be plainly marked.

C. All incandescent fixtures shall be provided with thermal protectors except where otherwise indicated or where approved for operation without such protectors by the N.E.C. and by the local building authority.

2.8 LAMPS

A. Provide lamps as shown in the fixture schedule or as modified in reviewed shop drawings.

B. Lamps as specified for the individual luminaries or lighting equipment shall be delivered and installed in fixtures and lighting equipment leaving these completely lamped and in normal operating condition.

C. Hot cathode fluorescent lamps, unless otherwise designated, shall be of the rapid start type only and deliver not less than 2,800 initial lumens for straight 4 ft. T-8 and 5,000 lumens for a 4 ft. T5HO lamps. Fluorescent lamps are triphosphor, color temperature 3,500°K, with a color rendering index of not less than 85, unless noted otherwise. Refer to light fixture schedule for details.

D. Provide all incandescent lamps inside frosted, unless noted otherwise. Refer to light fixture schedule for details.

E. High intensity discharge lamps, unless noted otherwise, shall be color corrected, phosphor coated, mogul base metal halide lamps. The mogul base color rendering index (CRI) shall not be less than 80 and a color shift not exceeding ±400K, unless otherwise specified. All medium base metal halide lamps to have a CRI of not less than 80 and color shift not exceeding ±200K. Refer to light fixture schedule for details.

F. LED lamp sources shall have a color temperature binning that does not exceed +/-200K. LED lamp life shall be rated at 70% of initial lumens remaining. LED drivers shall be used @ 100% output for lumen output rating and be not underdriven or overdriven.

G. Lamps shall be by the same manufacturer and produced by the following acceptable manufacturers:

1. General Electric Lighting
2. Osram Sylvania, Inc.
5. Others only where specified.

2.9 LAMPHOLDERS

A. Lamp sockets shall be rigidly attached to fixture enclosure or housing.
B. High intensity discharge lamp sockets shall be made of heavy duty heat-resistant porcelain.
C. Fluorescent lamp sockets operated with an open circuit voltage in excess of 300 volts shall be of the safety type, and open the supply circuit when the lamp is removed from the sockets.
D. Provide nickel plated brass or nickel and silver plated contacts in all lampholders for tungsten halogen lamps, lamps in outdoor fixtures, and mogul base incandescent, metal halide or mercury vapor lamps.
E. All lamp sockets shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fixture components. All adjustable sockets shall be preset at the factory for lamp specified.

2.10 FLUORESCENT AND HIGH INTENSITY DISCHARGE LAMP BALLASTS

A. All fluorescent and high intensity discharge lamp ballasts shall conform to the following:

1. All ballasts for a particular lamp type shall be of the same manufacturer and where possible all ballasts on the projects be of the same manufacturer.
2. All ballasts shall be “Class P” indicating approved integral ballast protection. Fuses in the primary leads shall be provided in addition to the “Class P” ballast.
3. All ballasts shall be of the electronic high power factor type, 0.90 or greater, energy saving, “super low heat” as manufactured by Advance, Philips, Universal, Motorola or approved equal.
4. All fluorescent ballasts shall be electronic, capable of maintaining a constant light output on all rapid start fluorescent lamps over operating range of 90V to 145V (120V ballast) and 200V to 320V (277 ballast). The total harmonic distortion (THD) of the ballast shall be less than 10 percent of the full light output current level. The ballast shall have a sequenced start progression which first heats cathode filaments and then ignites the lamp. The ballast shall withstand line transients as defined in ANSI/IEEE C62.41, category A; crest factor less than 1.4; power factor greater than 90% and operating frequency of 20KHZ or greater without a visible flicker. The case temperature shall not exceed 25ºC temperature rise over 40ºC ambient. Ballasts shall comply with FCC regulations Part 18, Class A.
5. All HID magnetic ballasts to be encapsulated and have maximum crest factor 1.6.
6. All HID ballasts shall meet U.L. standards for “Class H” operations (180ºC).
7. U.L. and ANSI specifications with labels and/or symbols of approval by the U.L. and of certification by the Certified Ballast Manufacturers (C.B.M.) as tested by the E.T.L.
8. The component parts shall be designed, fabricated, and assembled in accordance with the latest requirements of the N.E.C.
9. Ballasts shall provide safe and reliable operation of the specified lamps.
10. Whenever possible, provide two-lamp ballasts for fixtures with two fluorescent lamps or multiples of two lamps.
11. Lamp/Ballast combinations should be used to allow for maximum energy efficiency, unless otherwise specified.
12. Identical ballasts shall be installed within each fixture type.
13. For HID fixtures specified with remote ballasts, the contractor shall verify and coordinate the maximum distance from lamp to ballast allowed.
14. Fixture design, fabrication, and assembly shall be such as to prevent overheating or cycling of lamps and ballasts under normal operating temperature variations.
15. Provide the lowest sound rating available for the lamps specified and clearly show their respective sound ratings. Ballasts found by the Architect or Engineer to be unduly noisy shall be replaced without charge prior to acceptance of the work.
16. Dimming ballasts shall be provided where dimming controls are required per the drawings, notes and schedules. Dimmer type ballasts shall be of a design recognized and approved under the U.L. component program. These ballasts must coordinate with the dimming control devices specified for the particular application. Unless specified in the Lighting Fixture Schedule, all dimming ballasts shall dim to 10%. Basis of design shall be 0-10V dimming ballast.
17. Ballasts intended for outdoor use shall have a minimum lamp starting temperature of 0°F, except as noted otherwise.
18. Where ballasts are remote from fixture housing, provide suitable enclosure for installation with the conduit and wire from the ballast to the lamp socket clearly marked “Caution,” “High Voltage.” All remote ballasts to be installed within the recommended distance from the lamp socket as per the manufacturer with access plates for maintenance and on neoprene pads for sound absorption.
19. Ballast for T5 HO lamps or smaller shall have end of life sensing circuits.
20. Provide internal disconnecting means for ballast maintenance. Disconnecting means shall disconnect all conductors, including grounded conductor.

B. Ballasts manufactured by the following are acceptable:

1. Motorola/GE
2. Advance
3. Universal
4. Osram Sylvania
5. Approved Equal
6. Contractor to coordinate ballast line side voltage with branch circuit voltage as shown on Contract Drawings.

C. LED Lamps

1. Initial delivered lumens – thermal losses should be less than 10% when operated at a steady state at an average ambient operating temperature of 25°C, and optical losses should be less than 15%.
2. Average Delivered Lumens – Average delivered lumens over 50,000 hours should be minimum of 85% of initial delivered lumens.
3. LED boards, drivers and associated components shall have a Warranty of 5 years on the LEDs, 5 years on the driver, 10 years on the paint finish.
4. Driver Specification shall include:
   a. Be Electronic, Voltage range of (120-277) +/- 10%
      1) Current .35 Add (+/- 5%)
      2) Frequency 50/60 Hz
      3) Power Factor >90% at full load
      4) THD <20% at full load
      5) Load regulation: +/- 1% from no load to full load
      6) Output ripple <10%
      7) Output should be isolated
      8) Case temperature: rated for -40° through +80 °
9) Overheat protection, self-limited short circuit protection and overload protected
10) Primary fused
11) Life rating not less than 50,000 hours

2.11 REFLECTORS

A. Reflectors and reflecting cones or baffles shall be as follows:
   1. Absolutely free of any tooling marks including spinning lines, indentations caused by riveting or other assembly techniques.
   2. No rivets, springs, or other hardware visible after installation.
   3. First quality polished, buffed and anodized finish, “Alzak” or approved equal.
   4. Specular finish color as selected by the Architect or as specified in the fixture schedule.

B. Other aluminum reflectors shall be as follows:
   1. Formed and finished as noted on the Drawings and elsewhere in the Specification.
   2. Reflectors free from blemishes, scratches, or indentations which would distort their reflective function.
   3. Finished by means of the “Alzak” process or approved equal unless otherwise noted.

C. Reflector and housing shall comply completely enclose the fixture's fluorescent lamp in downlights in a plenum ceiling and provide the full rated output of the lamp. Fixtures that vent through the downlight reflector into the plenum are not acceptable.

2.12 LENSES

A. All lenses secured by positive means with neoprene or silicone gasketing or washers as required to hold the lens tight within a frame or attach to housing.

B. All glass lenses shall be heat treated (tempered) or sealed with a clear acrylic laminate layer to provide a “safety glass” rating. All lenses which require removal for relamping or normal maintenance shall be attached to the fixture housing by a minimal length of safety chain to prohibit the lens from falling and striking surrounding surfaces.

C. Acrylic lenses shall be 100 percent virgin acrylic polymer and colorless. For lenses with pattern of pyramids or cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones), or thickness of undisturbed material. All lenses shall be a minimum .156" thick.

D. The quality of the raw acrylic material must exceed IES, SPI, and NEMA Specifications by at least 100 percent which, as a minimum standard, shall not exceed yellowness factor of 3 after 2,000 hours of exposure in the Fade-o-meter or as tested by an independent test laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 15 years.

2.13 LOUVERS

A. All louvers shall be fabricated of the specified material.
B. All fluorescent light fixture louvers shall be parabolic and shall be rated at 90 percent or over on the VCP index.

C. Louver finishes shall be provided as specified.

D. All plastic parabolic louvers shall be destaticized before and after fabrication to insure minimum maintenance.

E. All metal louvers shall be coated with anti-rust material and electrostatically painted.

F. All louvers shall be heat tested to withstand lamp operating temperatures with no deformation of shape, paint blistering or discoloration.

2.14 FIXTURE TRIMS

A. Fixtures shall have finish trim designed for the following types of ceiling systems:

<table>
<thead>
<tr>
<th>Ceiling Type</th>
<th>Trim Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recessed Incandescent, Fluorescent, LED, or Metal Halide Fixtures</td>
<td>a. Plaster - Overlap Trim.</td>
</tr>
<tr>
<td></td>
<td>b. Concrete - Overlap Trim.</td>
</tr>
<tr>
<td></td>
<td>c. Tile - Overlap Trim.</td>
</tr>
<tr>
<td></td>
<td>d. Gypsum - Overlap Trim.</td>
</tr>
<tr>
<td></td>
<td>e. Metal Pan, Concealed M - Modular, Fit-in Support.</td>
</tr>
<tr>
<td></td>
<td>f. Lay-in - Modular, Tile with Flush Fit-in.</td>
</tr>
</tbody>
</table>

B. Provide trim details as shown on the Drawings or as specified, which are indicative of appearance and dimensional requirements. The trim finish and dimensions subject to the approval of the Architect.

C. Trimless fixtures shall be installed per manufacture’s guidelines and shall be installed and coordinated with other trades as required.

D. Mitered corners shall be continuously welded and smoothed before shop finish is applied. No lapping of trim metal for all flush mounted ceiling trims for rectangular or square recessed fixtures.

E. Provide a mounting frame or ring with lock recessed or semi-recessed light fixture to secure the mounting frame to the ceiling and support any reflectors, trims, or lenses. Ring shall be compatible with the ceiling and of sufficient strength to rigidly support the fixture and any stress applied in relamping.

F. Catalog numbers are included in the Lighting Fixture Schedule for reference. Provide all accessories and design features described herein regardless of whether such features are included in catalog reference including, mounting hardware, louvers, lenses, filters, transformers, etc.

2.15 LIGHTING FIXTURE TYPES AND CATALOG NUMBERS

A. General: Various fixtures types required are indicated on Lighting drawing Fixture Schedule. Fixtures must comply with minimum requirements as stated herein. Review architectural
drawings and specifications to verify and coordinate ceiling types, modules, suspension systems appropriate to installation.

2.16 AUXILIARY SUPPORTS FOR SUSPENDED FIXTURES

A. Provide separate and isolated suspension for all fixtures required by the Local Building Department and seismic requirements. This may include rod hangers, hook hangers, or single stem hangers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and associated substrate for supporting lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF LIGHTING FIXTURES

A. Contractor to coordinate exact quantities and critical dimension with field conditions.

B. Contractor to verify and coordinate that appropriate framing, support structures, mounting brackets, and other required structural connections are provided by the General Contractor or other trades to insure a timely, correct and neat installation of all luminaries.

C. Contractor to coordinate and provide any associated mounting hardware, conduit connections, or associated appurtenances to effectively install the luminaries. Provide each light fixture with complete installation instructions. All light fixtures to be installed in strict conformance with manufacturer’s recommendations and instructions.

D. Install lighting fixtures in accordance with fixture manufacturer’s written instructions, applicable requirements of NEC, NECA’s “Standard of Installation,” NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

E. Exact locations of all lighting fixtures including mounting heights and plan dimensions are as per the Architectural and/or Landscape Drawings. Any ambiguities or conflicts in this dimensional information to be identified to the Architect prior to installation.

F. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than specified herein, for review by Architect.

G. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

H. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

I. Fasten fixtures securely to structural supports, and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant (cable or rigid stem), fixtures longer than an
overall length of 2 feet with diagonal corrosion resistant aircraft cable bracing to minimize sway. Provide rigid stem hanger with ball aligners and provisions for minimum one inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.

J. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values for equipment connectors. Where manufacturer’s torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified on UL Stds. 486A and 486B and the National Electrical Code.

K. Support pendant mounted fixtures greater than an overall 2 feet in length at a point in addition to the outlet box fixtures stud with an appropriate safety cable. Certain decorative pendant fixtures may not require a safety cable, verify with Architect, Engineer or Lighting Designer.

L. Fasten electrical lighting fixtures and brackets securely to indicate structural supports, including poles/standards, and ensure that installed fixtures are plum and level.

M. Rigidly align all continuous rows of fixtures for true in-line appearance.

N. Do not install exposed fixtures, reflectors or trims until all plastering and painting that may mar fixture finish is completed. Replace blemished, dented, damaged or unsatisfactory fixtures as directed.

O. Support all fixtures independent of cable trays, ductwork or piping.

3.3 FIELD QUALITY CONTROL

A. Replace defective and burned out lamps for 3 months following the Date of Substantial Completion.

B. At Date of Substantial Completion, replace lamps in lighting fixtures which have been operational over 100 hours.

1. Refer to Division-1 sections for the replacement/restoration of lamps in lighting fixtures, where used for temporary lighting prior to Date of Substantial Completion.

C. Furnish stock or replacement lamps amounting to 5%, but not less than 4 lamps in each case, of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner’s storage space.

3.4 AIMING AND ADJUSTMENT

A. All adjustable lighting units shall be aimed, focused, locked, etc., by the Contractor under observation of the Architect, Engineer or Lighting Designer. All aiming and adjusting shall be carried out after the entire installation is complete. All ladders, scaffolds, etc., required shall be furnished by the Contractor. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely. The aiming and adjustment of luminaires must take place after the projects amenities have been completely installed. These amenities shall include but are not limited to plantings, furniture, artwork, graphics and signage.

B. Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing, aiming shall be accomplished at night.
3.5 CLEANUP

A. Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses. Two weeks prior to substantial completion, re-clean all fixtures for dust, fingerprints, and smudges from all visible parts of the fixture.

B. Protect installed fixtures from damage during remainder of construction period.

C. At the time of final acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, all broken parts shall have been replaced, and all lamps shall be operative.

3.6 GROUNDING

A. Provide equipment grounding connections for lighting fixtures as indicating. Tighten connections to comply with tightening torques specified in UL STD 486A to assure permanent and effective grounds.

3.7 DEMONSTRATION

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 265113
### FEATURES & SPECIFICATIONS

**INTENDED USE** — 2RT5 is designed for applications that require the extremely energy efficient delivery of consistent illumination levels through a fixture that is engaging and durable in design, ideal for offices, schools, hospitals, retail locations and other commercial applications. Certain applications continue to depend on the integrity of acrylic. Click here for a comprehensive environmental compatibility table for suitable materials.

**CONSTRUCTION** — Impact resistant acrylic phosphor reflector with pressure light diffusing film. Durable, one-piece, solid-state compact fluorescent with restructured phosphors. Projector style paint for cathode protection. Light structure with rapid mount and compliant with integral fuse clips.

**HOTELS** — Requires sophisticated lighting by filling the entire volume of space with light, delivering the ideal amount through corridors, work areas and public spaces.

**Issue Description:** ISSUE FOR BID

**Issue Date:** 16-Jun-11

---

### Ordering Information

**Example:** 2RT5 28T5 MVOLT GEB9S LP835P

<table>
<thead>
<tr>
<th>2RT5</th>
<th>Series</th>
<th>Lamp Type</th>
<th>Voltage</th>
<th>Halogen</th>
<th>LAMP</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>2RT5</td>
<td>Processed15</td>
<td>2RT5</td>
<td>54VDC (120V)</td>
<td>MWL7</td>
<td>LP835P</td>
<td>GIR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GE2855</td>
<td>.5 bulk factor</td>
<td>stop dimming</td>
<td>200W 200,000 hour</td>
<td>ER114</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GE2825</td>
<td>1.1 bulk factor</td>
<td>200W 200,000 hour</td>
<td>ED400P</td>
<td>E400W 200,000 hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d2815</td>
<td>1.1 bulk factor</td>
<td>stop dimming</td>
<td>200W 200,000 hour</td>
<td>EP440P</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d2815</td>
<td>1.1 bulk factor</td>
<td>stop dimming</td>
<td>200W 200,000 hour</td>
<td>EP440P</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2RT5</td>
<td>1.1 bulk factor</td>
<td>stop dimming</td>
<td>200W 200,000 hour</td>
<td>EP440P</td>
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<td>2RT5</td>
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<td></td>
<td></td>
<td>2RT5</td>
<td>1.1 bulk factor</td>
<td>stop dimming</td>
<td>200W 200,000 hour</td>
<td>EP440P</td>
</tr>
</tbody>
</table>

**Notes:**
1. For 50/60Hz applications use 54VDC 200W MVOLT GEB9S LP835P.
2. MVOLT 200W 200VAC 200W 200,000 hour.
3. For 50/60Hz use GE2855 or GE2825.
4. Drop options for LP835P.
5. Available with GE2815.
6. SIMPLYHD replaces 2RT5 MVOLT GEB9S LP835P.

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**CU LASP Sybase Space**

**Issue Description:** ISSUE FOR BID

**Issue Date:** 16-Jun-11
2RT5
2’ x 4’
2 Lamps
Premier or Premier XP5

LITHONIA LIGHTING

FEATURES & SPECIFICATIONS

INTENDED USE — 2RT5 is designed for applications that require the extreme energy efficient delivery of uniform luminous light transversely in a thin electrically-insulated and watertight enclosure. Ideal for offices, schools, hospitals, retail and commercial applications. Certain applications require the reduced intensity of acrylic. Click here for typical environmental compatibility test tables for various applications.

CONSTRUCTION — High-quality acrylic or polycarbonate reflector with thermostatic light-attenuating film. Aged, one-year-old, cold-white reflector with porcelain-enameled finish. Projector plate painted with black, highly reflective yellow, flat finish with integral glass baffle.

Other finishes are available at no additional cost.

OPTICS — Provides uniform lighting by filling the entire volume of space with light, eliminating the visual effect of the ceiling or walls. Luminaire dimensions are carefully managed to enhance uniformity and reduce the visual effects.

Recessed, two-piece reflector system reduces and softens the light and smoothly matches the reflector with the ceiling.

Integral light is placed above the reflector and recessed above the reflector plate to provide a high-efficiency ceiling and surface mounting.

Suspended or surface-mounted without the need to ceiling mounts while enhancing the perception of interior depth.

ELECTRICAL — Dimmable for use with triac or ELV systems (2 RT5). Can be provided with resistive, inductive, or ELV dimming. For use with a 0-10V dimming. Lamp(s) included with ceiling mount include a 0-10V dimming option.

0.05 in. USG factor standard for all applications. 0.05 in. USG factor or 15/5000 lamp shipped available for higher ceiling height applications.

Snap-in changeout options allow systems to be switched to 100% power for compliance with common energy codes while maintaining luminous intensity.

Notice: 0.05 in. USG factor standard for all applications. 0.05 in. USG factor or 15/5000 lamp shipped available for higher ceiling height applications.

INSTALLATION — UL Listed and listed for use with trac and surface mounting. Lamp and ballast includes a panic button for easy access.

LAYOUTING — UL Listed and listed for use with trac and surface mounting. Lamp and ballast includes a panic button for easy access.

WARRANTY — Limited warranty for use with ELV is a 10-year limited warranty and can be used with trac and surface mounting.

LAMP TYPE — Lamp type is a 10-year limited warranty and can be used with trac and surface mounting.

Example: 2RT5 28T5 MVOLT GEB90S LPM835P

ORDERING INFORMATION

For detailed drawings, contact products and pricing options.

Manufacturer: LITHONIA
Catalog Number: 2RT5-28T5-MVOLT-GEB90S-LPM835P

Project number: DV11004
Revisions:

CU LASP Sybase Space

Type: F1A

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11
2RT5 Volumetric Recessed Lighting 2' x 4'

Revisions:

NO. DATE REVISION

Project number: DV11004

CU LASP Sybase Space

Issue Description: ISSUE FOR BID

Issue Date: 16-Jun-11

Type: F1A
Revisions:

NO.        DATE            REVISION

Project number: DV11004

CU LASP Sybase Space

ISSUE FOR BID

Issue Description: ISSUE FOR BID

Issue Date: 16-Jun-11

Type: F2
6" AFV Open Reflector

Distribution data

AFV 25TRT 6AR. (1) PL-T 26W/30/4P lamp, 1800 rated lumens, 1.2 s/m, Test No. 94021501

AFV 32TRT 6AR. (1) PL-T 32W/30/4P lamp, 2400 rated lumens, 1.1 s/m, Test No. 17111

AFV 32TRT 6MB. (1) PL-T 32W/30/4P lamp, 2400 rated lumens, 1.0 s/m, Test no. 2196071001

NOTES:
1. For electrical characteristics consult Technical Bulletins tab.
2. Tested to current UL and NEMA standards under stabilized laboratory conditions. Various operating factors can cause differences between laboratory data and actual field measurements. Dimensions and specifications are based on the most recent raw data and are subject to change without notice.

DCF-370
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Manufacturer: GOTHAM
Catalog Number: AFV-32TRT-6AR-MVOLT

CU LASP Sybase Space

Type: F2

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11
FEATUERS

OPTICAL SYSTEM
- Self-flanged, semi-specular or matte-diffuse reflector.
- Patented Verture® - Bounding Ray® Optical Principle design (US Patent 4,600,050) provides lamp before lamp image. Lamp image that reflects smoothly from the top of the reflector to the aperture, providing optimal fixture performance and efficiency.

MECHANICAL SYSTEM
- 16-gauge galvanized steel mounting/plaster frame with friction support clips to retain optical system. Maximum 7/8" ceiling thickness.
- 16-gauge galvanized steel mounting bars with continuous 4" vertical adjustment are shipped pre-installed. Post installation adjustment possible without the use of tools from above or below ceiling.
- Galvanized steel junction box with hinged access covers and spring latch. Two combination 1/2"-3/4" and three 1/4" knockouts for straight-through conduit runs. Capacity: 8 1/4 in. 4 out). No. 12 AWG conductors, rated for 80°C.

ELECTRICAL SYSTEM
- Rugged aluminum lampholder housing.
- Vertically-mounted, positive-latch, thermoplastic socket.
- Class II, thermally protected, high power factor electronic ballast mounted to the junction box.
- Simply5™ technology available.

LISTING
- Fixtures are UL Listed for thru-branch wiring. Non-IC recessed mounting and damp locations. Listed and labeled to comply with Canadian Standards.

ORDERING INFORMATION

Example: AFV 32TRT 6AR MVOLT WLP

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Finish</th>
<th>Ballast®</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>120V</td>
<td>Clear</td>
<td>MVOLT®</td>
<td>EL®</td>
</tr>
<tr>
<td>277V</td>
<td>Black</td>
<td>Electronic Ballast</td>
<td>Emergency Battery Pack</td>
</tr>
</tbody>
</table>

NOTES
1. Not available with lens or trim.
2. Multi-volt electronic ballast capable of operating on any line voltage from 120V through 277V, 50 or 60 Hz.
3. For additional options, refer to Technical Bulletins tab.
4. Not available with 120V.
5. Available in 120V, 277V only.
6. Simply5™ includes 25 MLC Passive wiring system (wired separately). Available in 120V or 277V only. Not available in 120V or 277V. See line sheet for more information.
7. For dimensional changes, refer to Technical Bulletin tab.
8. For compatible retrofit systems, refer to Technical Bulletin tab.
9. Not available with EL or ELI options.
10. Requires additional light box or power supply.

Manufacturer: GOTHAM
Catalog Number: AFV-32TRT-6AR-MVOLT

Project number: DV11004
Revisions: NO. DATE REVISION

Type: F2B
**Project number:** DV11004

**Issue Description:** ISSUE FOR BID

**Issue Date:** 16-Jun-11

**Type:** F3
**FEATURES**

**OPTICAL SYSTEM**
- Self-ranged, semi-specular or matte-diffuse reflector with hybrid finish wallwash socket providing uniform vertical illumination and light high on the wall.
- Patented Vertsys®-Bunding Ray® Optical Principle design (US Patent #5,900,990) provides lamp before lamp image. Lamp image that reflects smoothly from the top of the reflector to the aperture, providing optimal fixture performance and efficiency.

**MECHANICAL SYSTEM**
- 16-gauge galvanized steel mounting/plaster frame with integral yoke and flat spring to retain optical system. Maximum 1-5/8" ceiling thickness.
- 16-gauge galvanized steel mounting bars with continuous 4" vertical adjustment are shipped pre-installed. Fast installation adjustment possible without the use of tools from above or below the ceiling.
- Galvanized steel junction box with hinged access covers and spring latch. Two combination 1/2"-3/4" and three 1/2" knockouts for straight-through conduit runs. Capacity: 8 (4 in, 4 out) No. 12 AWG conductors rated for 50°C.

**ELECTRICAL SYSTEM**
- Rugged aluminum lampholder housing.
- Vertically mounted, positive-latch thermoplastic socket.
- Class F, thermally-protected, high power factor ballast mounted to the junction box.
- SimplyE™ technology available.

**LISTING**
- Fixtures are UL Listed for thru-branch wiring, Non-IC recessed mounting, and damp locations. Listed and labeled to comply with Canadian Standards.

---

**ORDERING INFORMATION**

Observe the boldfaced cautionary notes that best suit your needs and write on the appropriate line.

**AFVV**

<table>
<thead>
<tr>
<th>Series</th>
<th>Wattage/Output</th>
<th>Aperture/Color</th>
<th>Finish</th>
<th>Lens Type</th>
<th>Voltage</th>
<th>Ballast</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFVV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>132TT</td>
<td>105W</td>
<td>Clear</td>
<td>Semi-specular</td>
<td>No lens</td>
<td>120</td>
<td>MVOLT</td>
<td>EUP</td>
</tr>
<tr>
<td>132TR</td>
<td>105W</td>
<td>Powder</td>
<td>Multi-diffuse</td>
<td>Clear glass lens</td>
<td>277</td>
<td>E90</td>
<td>GMP</td>
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<tr>
<td>132TR</td>
<td>105W</td>
<td>Umber</td>
<td>Multi-diffuse</td>
<td>Clear glass lens</td>
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<td>E90</td>
<td>GRP</td>
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<tr>
<td>26TR</td>
<td>180W</td>
<td>Wheat</td>
<td>Multi-diffuse</td>
<td>Clear glass lens</td>
<td>247</td>
<td>E90</td>
<td>TRW</td>
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<tr>
<td>32TR</td>
<td>180W</td>
<td>White</td>
<td>Multi-diffuse</td>
<td>Clear glass lens</td>
<td>247</td>
<td>E90</td>
<td>TRW</td>
</tr>
</tbody>
</table>

**NOTES**
1. Not available with finishes.
2. Not available with Ballast 650-listed.
3. SimplyE™ available for 99% MLC Retrofit wiring system (shipped separately). Available in 120v or 277v only. Not available in 277v. See catalog for more information.
4. For dimensional changes, refer to Technical Bulletins.
5. For competitive fixtures, refer to Technical Bulletins.
6. For compatible Retrofit systems, refer to Technical Bulletins.
7. A 26V dimming box is included with the fixture, providing dimming capability.
8. A 120V relay with 0-10V DC input is also available for use with third-party dimming systems.

**ACCESSORIES**

- Order accessories as shown.
- Single-end/dual-end dimming, electronic dimming, temperature control, emergency ballast, and other options available.
- Contact factory for more information.

---

**Manufacturer:** GOTHAM

**Catalog Number:** AFVV-26TRT-4AR-MVOLT

**Project Number:** DV11004

**Issue Description:** ISSUE FOR BID

**Issue Date:** 16-Jun-11

**Type:** F4
4" AFVV Open Wallwash

TECHNICAL INFORMATION

Footcandle values are initial and tables are based on minimum-rated lumens. For fixture-to-wall distances other than those shown, use maximum of one-to-one spacing (distance between fixtures not more than distance to wall) for best results.

<table>
<thead>
<tr>
<th>Fixture/lamp</th>
<th>Candle-power data</th>
<th>Footcandle values</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFVV 18TRT 4AR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1ST8X/SF35X/A/4P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200 rated lumens</td>
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<td>Test no. LTL992</td>
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<td>Plane angle</td>
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</tr>
<tr>
<td>Room side 105º</td>
<td>115º 125º 90º</td>
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<tr>
<td>Wall side 105º</td>
<td>115º 125º 90º</td>
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<td>100º</td>
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<tr>
<td>Luminous 3 turn wall</td>
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<tr>
<td>Luminous 5 turn wall</td>
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<td>No. 3 centers</td>
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</table>

NOTES:
1. For electrical characteristics, refer to Technical Bulletin tab.
2. Product is intended for use in the IEC and OSHA standards under normal operating conditions. Various operating factors can cause differences between laboratory data and actual field measurements. Dimensions and specifications are based on the most current available data and are subject to changes without notice.

DCF-330
6226 Gotham Rd., Denver, CO 80204
Phone: 303-421-1500
Fax: 303-421-1595

GOTHAM ARCHITECTURAL DOWNLIGHTING
1420 Lester Road, Cooper’s Corner 30392
Phone: 800-312-2225
Fax: 770-861-3299
www.gothamsighting.com

Manufacturer: GOTHAM
Catalog Number: AFVV-26TRT-4AR-MVOLT

CU LASP Sybase Space

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11

Project number: DV11004
Revisions: NO. DATE REVISION

Type: F4
Project number: DV11004

Revisions: NO. DATE REVISION

CU LASP Sybase Space

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11

Type: F5
FEATURES & SPECIFICATIONS

INTENDED USE — The industry's next generation in linear direct fluorescent products. This new compact, low-profile design offers our customers unique product features which improve the overall installation process and appearance while reducing labor cost, making it the most versatile solution for commercial, retail, manufacturing, warehouse, and other display applications.

ATTRIBUTES — Designed to accommodate a wide variety of T5 and T5HO lamp lengths. Channel offers the gripper back feature which strengthens the overall construction and allows for the use of the 2 springampa ring type back. Patented- pending fastener-less channel cover offers a secure fit design allowing for quick attachment and easy access without prying open.

CONSTRUCTION — Compact designed channel and cover are formed from cold-rolled steel with T5HO lamp channel. Locking lamp holder features a metal spring and tapper which strengthens the overall connection, while creating improved lamp stability. Design includes T5 socket, feature rotating collar and enclosed contacts. Improved lamp "snap 'n' lock" cap design allows for quick attachment. Patented- pending "three-point" type connector locks channel together for straighter and faster mounting, included as standard.

FINISH — High-gloss baked white enamelled finish (white standard). Powder-coat three-stage phosphato pretreatment ensures superior paint adhesion and rust resistance. Other channel paint finish options: black (MB), white, gray (OSAM) and galvanized (GALV). 

OPTICAL — Reflector options include solid or aperture designs in both symmetric and asymmetric configurations. Consult factory for special-aperture variations.

ELECTRICAL SYSTEM — Thermally protected, resetting, Class II, 600V, non-PCB, UL listed. Suitable for damp locations. AVN, TPN or THHN wire used throughout, rated for required temperatures.

INSTALLATION — Patented- pending "three-point" type connector locks channel together for straighter and faster mounting, included as standard. Ideal for surface-mount or suspended.

ORDERING INFORMATION — For important load ratings, configure product using standard options (shown in bold).

Example: Z1 54T5HO Z0ZSMR6 MVOLT GEB10PS

Catalog Number: Z-1-28T5-MVOL- GEB10PS

Revisions:

Issue Description: ISSUE FOR BID

Issue Date: 16-Jun-11

Project number: DV11004

Type: F5A
Z T5 Compact Strilight

MOUNTING DATA
For unit or new installation, surface or stem mounting. Unit installation — Minimum of two hangers required. Box installation — Two hanger per channel plus one per row required. Mounting Icons Illustrated.

DIMENSIONS

PHOTOMETRICS

Coefficients of Utilization

Zone Lumens % of Max Power

CU LASP Sybase Space

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11

Type: F5A
EGRESS
Fixtures
**900 Series**

**LED EDGE-LITE EXIT SIGN**

---

**Model Number:**

**Type:**

**Job:**

---

**STANDARD FEATURES**

- Recessed mounting and universal style enclosures
- Attractive aluminum extrusion design
- Standard colors: black, white and brushed aluminum
- Optional G2 Self-Test/Self-Diagnostic circuitry available
- Red or green superbright LEDs
- Constant, uniform illumination
- High clarity, optically true acrylic panels
- 6" characters with 3/4" stroke
- Optional 8" characters with 1" stroke, meets New York City code requirements for exit lighting
- Specify arrow configuration when ordering
- Field applicable chevrons available
- Mirror background supplied as standard for all double face signs
- 120/277V dual primary 60Hz input
- Short circuit protection
- Voltage surge protection
- 25 year warranty
- 5 year pro-rated warranty on battery

---

**BATTERY BACK-UP**

- Trickle charge circuitry for extended battery life
- Overcharge protection provided by zener diode
- Test button and LED AC/DC indicator conveniently located for easy testing and visual inspection
- Flasher/buzzer options meet ADA regulations
- Low voltage disconnect eliminates deep discharge
- Brown-out protection
- UL recognized maintenance-free lead acid battery
- ETL listed 90 minute emergency run time, 24 hour recharge time

---

**Specifications are subject to change without notice**

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10000032 4/00

Manufacturer: EXITRONIX
Catalog Number: 902-X-WB-GM-XX-BA-G2

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**Project number: DV11004**

<table>
<thead>
<tr>
<th>Revisions:</th>
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<th>DATE</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

**Type: X1**

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**CU LASP Sybase Space**

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**Issue Description:** ISSUE FOR BID

**Issue Date:** 16-Jun-11

---

**Address:**

10055 West 43rd Ave
Wheat Ridge, CO 80033
P:(303)421.6655

---

**Exitronix Catalog Number:** 902-X-WB-GM-XX-BA-G2
**Features**

**Application**

The LZ Series is an indoor emergency lighting unit with 18 - 85W capacity utilizing a sealed lead-calcium or nickel-cadmium battery in 6 or 12 VDC. Supplied standard with two halogen MR16 lamps. High-output LED based MR16 option provides increased spacing, additional run-time and/or increased remote capability. Matching remote heads are also offered. The integrated lamp design offers greater protection from vandalism.

**Construction**

Available in two housing sizes, one for standard capacity models (LZ2, LZ19) and increased depth for higher capacity models (LZ21 through LZ96). Made from UV stabilized thermoplastic with a snap-together design in white or black finish. Includes tool switch and AC-ON indicator.

**Installation**

Unit mounts to 3/4", 4", octagon or 4" square boxes. Back-plate provides a universal knockout pattern for mounting to outlet box. Keyholes provided for securing housing to wall surface. LZ2 and LZ19 can be ceiling mounted. All AC connections made inside unit housing.

**Illumination**

The LZ Series provides illumination with two halogen MR16 lamps positioned inside an adjustable "eyeball" style housing. Optional lamps for greater light output include 10W MR16 and maximum coverage.

**Compliance**

UL 924 Listed (optional damp location listed)

NFPA 70

NFPA 101

ADA compliant (LZ standard models only)


**Ordering Guide**

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity</th>
<th>Battery Type</th>
<th>Rating</th>
<th>Output Volts</th>
<th>Self-Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>LZ</td>
<td>10 Watts</td>
<td>Blank Lead-Calcium</td>
<td>Blank Standard Model</td>
<td>Blank 120V 12 Watts 10</td>
<td>Blank Self-diagnostic Electronics</td>
</tr>
</tbody>
</table>

1. Available on units with capacities of 20 watts or more
2. Not available with Nickel-Cadmium battery models
3. Available only on 15, 20 or 25 watt models
4. Must order with damp location on LZ2 model
5. Not available with damp location models
6. Not available with LED or LZ19 equipped unit
7. Not available with LZ2 option
8. Not available with LED or LZ19 equipped unit
9. Not available with LZ2 option

**Options**

- Blank 5W Halogen lamps
- 10W 18W Halogen lamps 1
- 39W LED lamps 2
- 3 Black finish
- 6 Wallwash
- 47 Unit supplied without lampheads 11
- 24K 24V-12VAC
- 61Hz operation 2
- 43 Auxiliary 9-contactor line cord, T9M27 only 11

**Manufacturer:** DUALITE

**Catalog Number:** LZ-LED MR16-1

---

**CU LASP Sybase Space**

**Issue Description:** ISSUE FOR BID

**Issue Date:** 16-Jun-11

**Project number:** DV11004

**Type:** X2
**TechSpecs**

**Standard Features:**
- External push-to-test switch and AC-DN indicator
- Low voltage (277V)
- Transformer isolation
- Temperature compensated charger circuitry
- MR16 Halogen lamp with rated 35000 hour life

**Optional Features:**
- Spectral® self-test/self-diagnostic circuitry monitors lamp status, lamp field transfer or battery and battery capacity, displays any fault, resets via a flashing code. Automatically runs periodic diagnostic routines to ensure unit readiness. Multicolor LED indicates fault condition and charging status.
- LED MR16 lamps rated at 50,000 hours the expectancy.
- Available without integral lamp heads for added run time or remote capacity operation.

**Rated Luminous Intensity Range:**
- Standard: 395 to 585 LM, 2850 to 4295 LM (10-20,000 Ha.
- Light output (LM): 21,000 LM, 24,000 LM
- Weight: 4.5 oz. depending on capacity

**Input Voltages:**
- 120VAC to 277VAC; 60 Hz; operation standard. Optimal 277VAC: 108 Hz.

**Power Consumption:**
- For LZ and LzX: Max. 3 W, 120VAC, or 277VAC
- For LZ and LzX: Max. 2 W, 120VAC, or 277VAC

**Power Consumption (LzX-Uni and larger):**

<table>
<thead>
<tr>
<th>Load-Amp Battery</th>
<th>Nickel-Cadmium Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Watt</td>
<td>12 Watt</td>
</tr>
<tr>
<td>2 Watt</td>
<td>12 Watt</td>
</tr>
<tr>
<td>1.5W</td>
<td>12 Watt</td>
</tr>
<tr>
<td>1.5W</td>
<td>12 Watt</td>
</tr>
</tbody>
</table>

**Dimensions:**

A : Standard size (0.72, 1.27) depth. 3.875" (9.8cm).

High capacity models exceed 5.875" (14.9cm).

**Application Data:**

- Spacing for 8W HAIL (MR16 lamp)
- Spacing for 12W HAIL (MR16 lamp)
- Spacing for optional 3W LED MR16 lamp

Meets Life Safety Code minimum illumination of 0.1 ft and average illumination of 1.3 ft. Assumes open space with no obstructions, mounting height of 7 ft, ceiling height of 9 ft and reference of 0.9/20.0 on a 3' path. Productivity files are available on the Dual-Lite website (www.dual-lite.com).

**Manufacturer:** DUALITE

Catalog Number: LZ-LED MR16-1

A Hubbell Lighting, Inc. brand and Hubbell Lighting, Inc. and The Hubbell Lighting, Inc. logo are trademarks of Hubbell Lighting, Inc. All rights reserved. Specifications subject to change without notice. Printed in U.S.A.

Project number: DV11004

Revisions:

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Type: X2
SPECIALITY
Fixtures
24"

SPECIFICATIONS:

Construction: Extruded aluminum body with molded plastic end caps

Finish: Options include White, Bronze & Satin Aluminum

Lens: Frosted acrylic lens specially formulated for LED use

Lamps: High output (140 lumens per watt) 1W LEDs available in 3000K or 4000K color temperature. Long-life, low maintenance: 50,000 hour lamp life @ 70% lumen maintenance. There are 4 diodes for every 8" circuit board, 8" fixture has 1 board (4 diodes), 18" fixture has 2 boards (8 diodes) & 24" fixture has 3 boards (12 diodes).

Electrical: Integrated 120V driver that allows for 120V connection by either cord & plug or hardware (using EVM-1, EVM-2 or EVM-3) with no external remote transformers or drivers.

Dimming: Dimmable with an ELV dimmer, not compatible with Lutron Maestro and Radio Ra2

Installation: Eco-Counter is easy to install with captive screws pre-installed in the end caps. The fixture utilizes CSL's SpeedLink system that allows for a plug-in or hardware (using hardware modules) installation as well as the ability to link fixtures together on a single 120V circuit up to 24 fixture (any size) by either butting fixture end to end or using SpeedLink connectors (QL-10 or QL-18).

Listing: UL and cUL task light listing for portable and hardwire installation

Warranty: Eco-Counter fixtures have a 3 year warranty on the driver & LED chips from time of purchase.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Finish</th>
<th>Accessories</th>
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</thead>
<tbody>
<tr>
<td>ECL-8X0-D</td>
<td>W (White)</td>
<td>EVM-1 (W/BZ/SA) Hard wire module w/ master switch</td>
</tr>
<tr>
<td>ECL-16X0-D</td>
<td>Z (Bronze)</td>
<td>EVM-2 (W/BZ/SA) Hard wire module</td>
</tr>
<tr>
<td>ECL-24X0-D</td>
<td>S (Satin Aluminum)</td>
<td>EVM-3 (W/BZ/SA) Hard wire module dual knockouts</td>
</tr>
</tbody>
</table>

EXAMPLES:

- ECL-16-WT-D EVM-2WT QL-18WT

CREATIVE SYSTEMS LIGHTING - A Division of Troy-CSL Lighting, Inc.
14500 National Avenue, City of Industry, CA 91744 Tel: 826-336-4511 Fax: 626-330-4288 www.cslighting.com

Manufacturer: CSL LIGHTING
Catalog Number: ECL-24-WT

CU LASP Sybase Space

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11

Type: SP1
ULTRA-EFFICIENT 120V LED TASK LIGHTING

Hardwire Module
Required for hardwiring. ROMEX connector included. The Wiring Module/ Switch may be connected to the end of the Eco-Counter fixture or mounted in a more convenient location and connect to the fixture with a SpeedLink interlink cable. EWM-2 is a wiring module only for use with ROMEX or flex conduit.

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Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11

Type: SP1

Manufacturer: CSL LIGHTING
Catalog Number: ECL-24-WT
Project number: DV11004
Revisions:

EWM-1 Wiring Module/ Switch
controls multiple units from one switch, when installed at beginning of run

EWM-2 Wiring Module

EWM-3 Dual Knockout Wiring Module

Portable 8' Cord Plug: Black or White

SpeedLink Interlink Cables: Available in 10’ and 18’ lengths, Black or White

Desc. | Black | White
--- | --- | ---
8' plug | PL-96 BK | PL-96 WT

AVERAGE RATED LAMP LIFE

ECO FOOTCANDLE CHART
8' Model

CREATIVE SYSTEMS LIGHTING - A Division of Troy-CSL Lighting, Inc.
14688 Nelson Avenue, City of Industry, CA 91744  Tel: 826-398-4511  Fax: 826-390-4268  www.cslighting.com

UL

Manufacturer: CSL LIGHTING
Catalog Number: ECL-24-WT
Project number: DV11004
Revisions:

CU LASP Sybase Space

Issue Description: ISSUE FOR BID
Issue Date: 16-Jun-11

Type: SP1
# UNIVERSITY OF COLORADO AT BOULDER, LASP
# MECHANICAL SPECIFICATIONS
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**DIVISION 22**
- **SECTION 22 05 00** COMMON WORK RESULTS FOR PLUMBING
- **SECTION 22 07 00** PLUMBING INSULATION
- **SECTION 22 10 00** PLUMBING PIPING
- **SECTION 22 30 00** PLUMBING EQUIPMENT
- **SECTION 22 40 00** PLUMBING FIXTURES

**DIVISION 23**
- **SECTION 23 05 01/26 05 01** MECHANICAL AND ELECTRICAL COORDINATION
- **SECTION 23 05 02** BASIC MECHANICAL REQUIREMENTS
- **SECTION 23 05 03** BASIC MECHANICAL MATERIALS AND METHODS
- **SECTION 23 05 13** MOTORS AND STARTERS
- **SECTION 23 05 21** PIPE AND PIPE FITTINGS
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- **SECTION 23 05 93** TEST-ADJUST-BALANCE
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- **SECTION 23 37 00** AIR INLETS AND OUTLETS
- **SECTION 23 62 13** AIR-COOLED CONDENSING UNITS
- **SECTION 23 73 24** SPLIT SYSTEM DX AIR HANDLING UNITS
- **SECTION 23 90 00** PROJECT CLOSEOUT
PART 1 – GENERAL

1.1 REFER TO RELATED SECTIONS

A. Section 23 05 01 – Mechanical and Electrical Coordination
   Section 23 05 02 – Basic Mechanical Requirements
   Section 23 05 03 – Basic Mechanical Material and Methods
   Section 23 05 13 – Motors and Starters
   Section 23 05 21 – Pipe and Pipe Fittings
   Section 23 05 22 – Piping Accessories
   Section 23 05 23 – Valves
   Section 23 05 29 – Pipe Support and Anchors
   Section 23 05 48 – Vibration Control
   Section 23 05 53 – Mechanical Identification

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 220500
PART I – GENERAL

1.1 REFER TO RELATED SECTIONS

A. Section 23 07 00 – Mechanical Insulation

PART 2 – NOT USED

PART 3 – NOT USED

END OF SECTION 220700
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplemental Conditions of the Construction Contract and Division 1 Specification Sections (General Requirements), apply to this Section.

1.2 SUBMITTALS

A. Submit manufacturer’s data on the following:

1. Water hammer arresters.
3. Floor drains, cleanouts and area drains.
4. Trap primers

1.3 STANDARDS

A. Materials shall comply with the following standards.

1. Cast iron pipe:
   a. ASTM A-74-87
   b. CISPI

2. Cast iron pipe fittings:
   a. ASTM A-888
   b. CISPI

3. Cast iron pipe couplings ASTM C-564

4. Copper pipe:
   a. Type K, L: ASTM B88

5. Ductile iron pipe: ASTM A377-89

1.4 RELATED WORK

A. Section 230529 Pipe Supports and Anchors.
PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING AND ACCESSORIES

A. **Above Ground Inside:**
   1. Pipe: Copper tube, hard temper, Type K.
   2. Fittings: Wrought copper, or cast bronze.
   3. Solder: For tubing less than 2", lead free solder with 10,000 PSI shear strength. For tubing 2" and above, use 15% silver solder (lead free).
   4. 1-1/2" and smaller – solder fittings.
   5. 2" larger – braze fittings.

B. **Above Ground Inside Building**, Size 5" and larger:

C. **Below Ground Inside Building**, Size 2" and Under:
   1. Pipe: Copper tube, annealed, Type K.
   2. Fittings: Wrought copper, brazed.

D. **Below Ground Outside Building**, 2 ½ " and Over:
   1. Ductile pressure pipe, tar coated, cement lined:

E. Use approved fittings for connections between dissimilar pipe systems.

F. Sprinkler piping and fittings for dry pipe system shall be galvanized, schedule 40 minimum (unless schedule 10 is approved by the AHJ). All fittings on galvanized piping shall be galvanized in accordance with ASTM A153.

2.2 WATER HAMMER ARRESTER (SHOCK ABSORBERS)

A. Manufacturers:
   1. Design Basis: Zurn Shoktral Z-1700
   2. Construction: Stainless Steel, Bellows
   3. Other Acceptable Manufacturers:
      a. Josam
      b. Sioux Chief
      c. J.R. Smith

2.3 TRAP PRIMERS (TP)

A. Manufacturers:
   1. Design basis: PPP (solenoid style) or Zurn (connection to flush valves) as noted in Plumbing Fixture Schedule.
   2. Construction: Corrosion resistant brass. “O” rings shall have a flexibility range of -40°F to 450°F.
   3. Provide distribution units for connector points as shown on plans.
   4. Complies with ASSE STD 1018.

2.4 TRAP GUARDS (TG)

A. Manufacturers:
   1. Design basis: ProSet Trap Guard
   2. Construction: A flexible tube made of elastmeric material that is treated to roll up when water is passing through drain.
   3. Install in floor drains and floor sinks from 2” up to and including 4” as shown on plans indicated with a (TG) behind drain designation.
   4. Larger sizes can be custom made by ProSet upon request.
   5. Use of trap guards as approved by local authority.

2.5 SANITARY AND VENT PIPING (WITHIN BUILDING)

A. Above Ground:
   1. Cast iron hub and spigot, neoprene gasket.
   2. Cast iron no hub, neoprene gasket and stainless steel sleeve joint.

B. Exposed in finished spaces:
   1. Type L copper with threaded fittings.

C. Underground:
   1. Cast iron hub and spigot, neoprene gasket.

2.6 HEAVY DUTY NO HUB COUPLINGS

A. Use on the following:
   1. All storm piping, reference section 22 10 00 3.4.A below.
   2. Underground sanitary pipe.

B. 1-1/2”, 2”,3” and 4”: 3” wide 304 stainless steel shield; (4) minimum stainless steel clamps; fixed and “floating” eyelet.

C. 5” and over: 4” wide 304 stainless steel shield, with six (6) stainless steel clamps mounted in series.

D. Torque to minimum 80 inch pounds or per manufacturer’s recommendation.
E. Acceptable manufacturers: Husky Series 4000 or Mission Heavy Weight.

F. Comply with requirements of ASTM C1540-02.

2.7 STANDARD DUTY COUPLINGS

A. Standard duty couplings shall conform to CISPI 310-85: 0.008” thick corrugated stainless steel.

B. Use of the following:
   1. Sanitary vent piping up to and including 3” piping.
   2. Sanitary piping up to and including 2” piping.

C. Torque to inch pounds per manufacturer’s recommendation.

D. Acceptable manufacturers: Tyler, Mission, AB&I, Clamp All, Huskey.

E. Comply with requirements of ASTM C1277-04.

2.8 PUMPED SANITARY PIPING (ABOVE & BELOW GRADE)

A. Type L copper with threaded fittings. (DWV copper is not permitted).

B. 125 lb. galvanized steel, threaded.

C. Hub and spigot or no hub couplings are not allowed.

2.9 SOIL AND VENT PIPING PRODUCTS

A. Use approved fittings for connections between dissimilar pipe systems.

B. Manufacturers:
   1. Acceptable Manufacturers:
      a. Josam
      b. Wade
      c. Zurn
      d. J.R. Smith
      e. Jones Spec
      f. Watts Ancon

C. Cleanout Plugs:
   1. Material: Cast bronze or brass.
   2. Type: Countersunk.

D. Wall Cleanout Covers:
   1. Type: Frameless, round, low profile plate.
2. Material: Stainless steel or chrome plated brass.
3. Attachment: Single exposed flush screw.
4. Finish:
   b. Surfaces to be painted: Prime coat.

E. Floor Cleanouts:
2. Attachment: Bronze screws.
3. Sleeve: Full thickness of floor slab. Refer to Section 230522 for required heights above slab.
4. Top:
   a. Shape:
      1) Where floor covering has rectangular pattern: Square.
      2) Other areas: Round.

5. Cover:
   a. For Vinyl Tile and Similar Floor Coverings: Recessed to receive inset of floor material.
   b. For carpeted floor covering provide carpet cleanout marker.
   c. Other areas: Nickel bronze scoriated finish.

PART 3 - EXECUTION

3.1 GENERAL

A. Testing
1. Test piping in accordance with the International Plumbing Code, except for storm piping, which is described below.
2. In addition to applicable Plumbing Code requirements, roof drains shall be tested with water from discharge of the building up to the nearest roof drain. If there are roof drains higher than the nearest drain, the section between these drains shall be tested separately.

B. Connections to Equipment Furnished Under Other Sections:
1. Make final connections to all equipment shown on drawings as connected to supply and/or drain piping.
2. Furnish all devices necessary for final connection, including:
   a. Tail pieces
   b. Stops
   c. Supplies
3. All equipment with natural gas shall be provided with a gas cock for manual isolation near connection to equipment.
C. Corrosion Protection:
   1. Provide isolation between concrete or mortar and any copper pipe.
   2. All below grade piping shall be adequately protected from corrosion.

D. Comply with Section 23 05 29 Pipe Supports and Anchors for pipe support requirements.

3.2 INSTALLATION OF DOMESTIC WATER PIPING AND PRODUCTS

A. Install all horizontal water piping level and parallel to building construction (except piping noted to be drained down slope toward drain at 1/8"/ft. min.). Make any changes in direction with fittings, don’t kink or bend. All vertical piping to be plumb. Provide dielectric isolation between uninsulated pipe and hangers. Provide plastic grommets when going through metal studs. Tape is not acceptable for dielectric isolation.

B. Water Hammer Arrestors: Install arresters as shown on the drawings. At minimum any branch line connected to a flush valve shall have one arrester.

C. Valves on domestic water system to be full port with stainless steel ball and stem.

D. Disinfection:
   1. To be performed by an independent contractor.
   2. After installation of all fixtures served, fill all domestic water lines with a chlorine-water solution of 50 parts per million minimum.
   3. Hold solution in pipe for at least 24 hours.
   4. Open and close all valves 3 times during chlorination.
   5. Waste chlorine solution from each outlet.
   6. Measure solution at end. If not 10 ppm, repeat.

3.3 INSTALLATION OF SANITARY AND VENT PIPING

A. Couplings: See Part 2 for use of standard and heavy-duty couplings.

B. Gaskets: Install gaskets in accordance with manufacturer’s recommendations for the use of lubricants, cements, and other special installation requirements.

C. Joint Adapters: Make joints between cast iron pipe and other types of pipe with standard manufactured cast iron adapters and fittings.

D. Cleaning Piping:
   1. Clear the interior of pipe of dirt and other superfluous material as the work progresses.
   2. Place plugs in the end of uncompleted pipe at the end of the day or whenever work stops.

E. Test Plugs:
   1. Provide test plugs in floor drains and roof drains at the time of installation.
   2. Leave test plugs in place for the duration of construction until sewer or drainage system is complete.
F. Vent Flashing:
   1. Provide 4 lb. sheet lead (24” x 24” minimum).
   2. Extend lead 5” above the vent and turned down into vent pipe.
   3. Refer to Section 7600 for single ply roof system components.

G. Vent Location: Do not install vents within 2 ft. of roof edge, parapet, wall line, or an “on-the-roof structure” and within 10 ft. of any air intake.

3.4 TRAP PRIMERS
   A. Install all trap primers and required distribution units as shown on plans and as required by manufacturers recommendations.

3.5 TRAP GUARDS
   A. Install elastmeric trap guards in specified floor and sink drains as indicated on plans.

END OF SECTION 221000
PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit manufacturer’s product data for the following:
   1. Domestic water heaters.
   2. Warranty and service policies.

1.2 WARRANTY

A. Water Heater:
   1. Furnish a certificate of 2 year warranty.
   2. The warranty shall not be on a pro-rated basis.
   3. The heater will have a first year service policy including labor, which will cover replacement labor and freight costs under certain conditions.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATER

A. Manufacturers:
   1. Design Basis: As scheduled on drawings
   2. Other acceptable manufacturers:
      a. State
      b. Rheem
      c. Rudd
      d. Bradford White
      e. A.O. Smith

B. Construction:
   1. Tank: Steel with glass lining, with cathodic protection.
   2. Jacket: Heavy gauge steel with baked enamel finish.
   3. Controls:
      a. 120 volt control circuit transformer.
      b. Transformer fusing.
      c. Magnetic contractors.
      d. Immersion style operating thermostats.
      e. Element fusing per N.E.C.
      f. High limit switch.
      g. ASME temperature and pressure relief valve.
2.2 INSTANTANEOUS POINT-OF-USE ELECTRIC WATER HEATER

A. Acceptable Manufacturers:
   1. Chronomite
   2. Eemax
   3. PVI

B. Construction and Accessories:
   4. Stainless steel heating elements.
   5. Built-in temperature shutoff at 190 degrees.
   6. 0.5 GPM inline flow control fitting.
   7. Flow switch activated at 0.4 GPM and shutoff at 0.3 GPM

PART 3 - EXECUTION

3.1 DOMESTIC HOT WATER HEATER

A. Installation:
   1. Make connections between water heaters and domestic water piping system with dielectric waterways.
   2. Install isolation valves at both cold water and hot water connections to water heater.
   3. Furnish and install copper drain piping from temperature and pressure relief valve for water heater.
      a. Furnish drain full size of relief valve opening and extend as indicated.

B. Adjusting:
   1. Provide start-up and adjustment by factory authorized personnel. A copy of the start up report will be provided to the owner.
   2. Upon completion of water heater installation, verify satisfactory control operation under maximum demand conditions as recommended by manufacturer.
   3. Adjust discharge water temperature as required. Make control adjustments required.

END OF SECTION 223000
PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit manufacturer’s product data for plumbing fixtures and accessories, in accordance with Division 1.

PART 2 - PRODUCTS

2.1 GENERAL

A. All manufacturers are listed in alphabetical order and not by preference.

B. Provide factory fabricated fixtures.

C. Provide trim, carriers, valves and accessories as required for complete installation.

1. Sink and lavatory drain trim to be 17-gauge.

D. All carriers are floor mounted unless otherwise noted. All carriers shall be bolted down to floor structure with 1/2” bolts and anchors.

E. Refer to Drawings for “Plumbing Fixture Schedule”.

F. Comply with Local, State and Governing ordinances concerning maximum water requirements of plumbing fixtures: Tank type W.C. and flush valve type W.C. = 1.6 gal./flush; lavs = 0.5 gpm; urinals = 0.125 gal./flush and showers = 2.0 gpm.

G. All valves, fixtures and accessories in contact with domestic water shall meet the requirements of NSF/ANSI Standard 61.

H. Stop valves: All brass construction, ¼ ball valve with handle.

2.2 PLUMBING FIXTURES

A. Acceptable Manufacturers:

1. Water Closets:
   a. American Standard
   b. Kohler

2. Sink:
   a. Bradley
   b. Elkay
   c. Just

3. Urinals:
   a. Zurn

4. Flush Valve:
   a. Sloan
   b. Zurn

5. Lavatories:
   a. American Standard
b. Kohler  
c. Crane

6. Faucets  
a. Chicago  
b. Zurn

B. Water Closets:
   1. Unless otherwise specified, all water closets are vitreous china water saver type, white.  
   2. All flush valves, stops and supplies are to be chrome plated brass. Flush valves to be non hold open type. See section 2.3.

C. Urinals:
   1. Unless otherwise specified, all urinals are vitreous china water saver type, white.  
   2. All flush valves are to be chrome plated brass, non hold open. See section 2.3.

D. Lavatories:
   1. Unless otherwise specified, all lavatories are white.  
   2. Provide chrome plated brass angle stops, supplies, tail piece, P trap and grid strainer for all lavatories.  
   3. Provide offset P traps on all ADA lavatory installations.

2.3 FLUSH VALVES

A. Exposed diaphragm type, chrome plated flush valve. Valves will have paraflow diaphragm kit for flush discharge adjustment. Valve will be a non-hold open, and have no external volume adjustment. Valve will have ADA compliant handle, back check control stop will have a sweat solder adapter kit with cast set screw with flange. Valve body, cover, tailpiece and control stop will be in conformance with ASTM alloy classification. Valve will be in compliance with applicable sections of ASSE 1037 and ANSI A117.1 requirement for people with disabilities.

2.4 WATER CLOSET SEATS

A. Acceptable Manufacturers:
   1. Beneke  
   2. Bemis  
   3. Church  
   4. Olsonite

B. Construction: Unless otherwise specified seats shall be heavy duty solid plastic, black with open front, concealed self sustaining check hinge less cover. Seat shall have an antimicrobial compound as an integral part of the plastic and shall match shape of bowl (elongated or regular).

2.5 FLOOR DRAINS

A. Acceptable Manufacturers:
   1. Josam  
   2. JR Smith
3. Wade  
4. Zurn  
5. Watts Ancon  

B. Body: Duco cast iron, with flashing collar.  

C. Grates and sediment strainers as specified in schedule.  

D. Provide primer taps as specified in schedule.  

2.6 EQUIPMENT FURNISHED UNDER OTHER SECTIONS  

A. Provide all materials necessary to make final connections to owner equipment furnished under other Sections of these Specifications including:  

1. Tail pieces  
2. Stops  
3. Supplies  
4. P traps, standard and/or offset  
5. Escutcheons  

PART 3 - EXECUTION  

3.1 INSTALLATION  

A. General: Install each fixture with P trap with cleanout plug, easily removable for servicing and cleaning.  

B. Provide chrome plated, rigid or flexible supplies to fixtures with stops, reducers and escutcheons.  

C. Finish wall and floor penetrations when exposed to view in finished areas with set screw type, chrome plated brass escutcheons.  

D. Set plumbing fixtures level and plumb, spaced in accordance with architectural dimensioned drawings, and securely install to be rigid.  

E. Install wall mounted lavatories, urinals and water closets with wall carriers mounted to the floor.  

F. Solidly attach floor mounted carriers for all fixture to floor using proper fasteners based on floor construction.  

G. Cover fixture bolts with china bolt caps of the same color where required.  

H. All wall mounted fixtures to be caulked between fixture and wall.  

I. Securely anchor flush valves behind or within walls to be rigid and not subject to movement due to push or pull action on the valve.  

J. Fixture Mounting Heights:
1. Refer to Architectural drawings and ADA standards.

K. Floor Drains:

1. Refer to Architectural drawings for exact locations and additional installation requirements.
2. Install floor drains with P-traps and vent as required.
3. Install drains on the center line of sheet lead pan and/or membrane in waterproofed areas and in floors above lowest floor.
4. Clamp pan and/or membrane into drain flashing collar.
5. Install strainers immediately after completion of finish floor installation.
6. Coordinate locations with mechanical equipment.
7. Install trap primers as indicated.

3.2 ADJUSTING AND CLEANING

A. Cleaning:

1. Clean strainers, traps, aerators, and valves of debris, sand and dirt.
2. At completion, thoroughly clean plumbing fixtures and equipment.

B. Adjusting: After cleaning and flushing operations are accomplished, adjust flush valves, faucets, showers, bubblers for proper flow.

3.3 PROTECTION

A. Protect fixtures and related components from damage before, during, and after installation to date of Final Acceptance or Owner move-in. Provide protective coverings or other protection as required.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit.

C. Feasibility and match to be judged by Architect or Engineer.

D. Remove cracked or dented units and replace with new units.

E. Contractor shall be responsible for replacing damaged fixtures or components.

END OF SECTION 224000
PART 1 - GENERAL

1.1 RESPONSIBILITY

A. The Division 21, 22, 23 and 26 contractor(s) shall comply with the provisions of this section. The Division 21, 22 and 23 and 26 contractor(s) shall verify electrical service provided by the electrical contractor before ordering any mechanical equipment requiring electrical connections. Provide submittals of all mechanical equipment to Division 26 and 28 contractor(s).

B. The final responsibility for properly coordinating the electrical work of this section shall belong to the Division 21, 22 and 23 system contractor performing the work, which requires the electrical power.

1. Each contractor shall be responsible for providing power wiring for certain devices as described in the specifications and on the drawings. This work shall be provided by a licensed electrician in accordance with all of the applicable provisions of the Division 26 and 28 specifications, NEC and local codes.

1.2 WORK INCLUDED

A. Carefully coordinate the interface between Division 21 (Fire Protection), Division 22 (Plumbing Protection) and 23 (Mechanical HVAC and Controls) and Division 26 (Electrical) and 28 (Fire Alarm) before submitting any equipment for review or commencing installation.

B. This Division of the Specifications may also be referred to by other Divisions of the Specifications, or on the Contract Drawings.

1.3 DEFINITIONS

A. Automatic: Pertaining to a function, operation, process or device that, under specified conditions, functions without intervention by human operator.

B. Disconnect Switch: A mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from a power source.

C. Control Circuit/Power: The circuit which carries the electrical signals of a control apparatus or system directing the performance of the controller but does not carry the main power circuit.

D. Manual Operation: Operation by hand without the use of any other power.


F. PC: Plumbing Contractor = Division 22.

G. MC: Mechanical Contractor = Division 23 Contractor who furnishes motor.

H. TC: Temperature Controls = Division 23 Contractor who furnishes control.

I. EC: Electrical Contractor = Division 26 Contractor.

J. FA: Fire Alarm Contractor = Division 28 Contractor who furnishes Fire Alarm System.

L. PE: Pneumatic to Electric Converter.

1.4 RESPONSIBILITY SCHEDULE

A. Responsibility: Unless otherwise indicated, all motors and controls for Division 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

<table>
<thead>
<tr>
<th>ITEM - Description</th>
<th>Furnished Under</th>
<th>Set In Place Under</th>
<th>Power Wiring Under</th>
<th>Control Wiring Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHU Interior Marine Lights</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
</tr>
<tr>
<td>Equipment Motors</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>--</td>
</tr>
<tr>
<td>Automatically or Manually Controlled Starters/Contactors: (Note 4)</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
<td>EC</td>
</tr>
<tr>
<td>-Separate</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
</tr>
<tr>
<td>-Factory Mounted and Wired</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
<td>EC</td>
</tr>
<tr>
<td>Motor Speed Controllers: (Note 4)</td>
<td>MC</td>
<td>EC</td>
<td>MC</td>
<td>EC</td>
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<tr>
<td>-Separate</td>
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<tr>
<td>-Factory Mounted and Wired</td>
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<tr>
<td>Disconnect Switches (Note 1)</td>
<td>EC</td>
<td>EC</td>
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<td>--</td>
</tr>
<tr>
<td>Thermal Overload Switches (Note 1)</td>
<td>EC</td>
<td>EC</td>
<td>EC</td>
<td>--</td>
</tr>
<tr>
<td>Switches (Manual or Automatic other than disconnect) (Note 2)</td>
<td>MC or TC</td>
<td>MC or TC</td>
<td>EC or TC</td>
<td>TC or MC</td>
</tr>
<tr>
<td>Control Relays (Note 2)</td>
<td>MC or TC</td>
<td>MC or TC</td>
<td>--</td>
<td>TC</td>
</tr>
<tr>
<td>Control Transformers</td>
<td>MC or TC</td>
<td>MC or TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Push Button Stations</td>
<td>MC</td>
<td>EC</td>
<td>EC</td>
<td>EC</td>
</tr>
<tr>
<td>Thermostat and Controls: Integral with Equipment or Directly Attached to Ducts, Pipes, etc. (Note 2)</td>
<td>MC or TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Equipment in Temperature Control Panels</td>
<td>TC</td>
<td>TC</td>
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<td>TC</td>
</tr>
<tr>
<td>Standalone Control Panels (BAS) (Note 6)</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Valve Motors, Damper Motors, Solenoid Valves, etc.</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>EP Valves or Switches, P.E. Switches, etc.</td>
<td>TC</td>
<td>TC</td>
<td>--</td>
<td>TC</td>
</tr>
<tr>
<td>Fire Alarm System (Note 3)</td>
<td>FA</td>
<td>FA</td>
<td>EC</td>
<td>FA</td>
</tr>
<tr>
<td>Fire Sprinkler Alarm (Note 3)</td>
<td>FP</td>
<td>FP</td>
<td>EC</td>
<td>FA</td>
</tr>
<tr>
<td>Duct System Smoke Detectors (Note 5)</td>
<td>FA</td>
<td>MC</td>
<td>--</td>
<td>TC/FA</td>
</tr>
<tr>
<td>Relays for Fan Control via duct detectors (Note 5)</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>TC</td>
</tr>
<tr>
<td>CO Sensors</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Control Air Compressor</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Refrigerated Air Dryer</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
<td>TC</td>
</tr>
<tr>
<td>Equipment Interlocks</td>
<td>TC</td>
<td>TC</td>
<td>--</td>
<td>TC</td>
</tr>
<tr>
<td>Fire/Smoke and Smoke Dampers (Note 7)</td>
<td>MC</td>
<td>MC</td>
<td>EC</td>
<td>FA</td>
</tr>
</tbody>
</table>
HEATING VENTILATING AND AIR CONDITIONING

DIVISION 23 – PAGE 3

SECTION 230501/260501

MECHANICAL AND ELECTRICAL COORDINATION

<table>
<thead>
<tr>
<th>ITEM -</th>
<th>Furnished Under</th>
<th>Set In Place Under</th>
<th>Power Wiring Under</th>
<th>Control Wiring Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Indication Devices (i.e., current sensors, end switches, airflow sensors)</td>
<td>TC</td>
<td>TC</td>
<td>--</td>
<td>FA/TC</td>
</tr>
</tbody>
</table>

Notes:

1. If furnished as part of factory wired equipment furnished and set in place by MC, wiring and connections by EC.
2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished by MC, but they shall be set in place and connected by EC, except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be furnished and set in place by MC and connected by EC. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired by TC contractor.
3. Pre-action system initiation signals (such as smoke detectors, or general alarm conditions in a pre-action zone) shall be provided under Division 28.
4. Electrical contractor is responsible for wiring from starter to motor, unless factory wired.
5. Temperature control contractor shall provide conduit and wire from auxiliary contact in motor starter to the detector so that the unit shuts down in all operating modes. Fire Alarm Contractor to wire from detector to fire alarm panel.
6. Each division shall be fully responsible for any control panels as called for on the drawings or specifications.
7. Division 23 and 26 shall provide all power and control wiring to fire/smoke or smoke dampers along with initiation signals to temperature control panels as described in the specifications.
8. TC wiring required only when damper also serves HVAC system.
9. TC wires to components utilized in the control and monitoring of the Automated Building Control System.

B. Power Wiring by Division 23: The electrical power for certain equipment provided under Division 23 has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the Division 23 or Division 22 or Division 21, whichever trade requiring such power.

Sufficient power for this purpose shall be furnished as “spare” dedicated circuit capacity in Division 26’s panelboards. All wiring, conduit and electrical devices downstream of the panelboards is the responsibility of the Division 23 trade requires the power.

1. Such equipment is hereby defined as:
   a. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings.
   b. Fire protection air compressors, dry-pipe control panels and valves. Required connections are to be included in the Division 21 work, and will be shown by that contractor’s engineered system design drawings.

   1) Pre-action system initiation signals (such as smoke detectors, or general alarm conditions in a pre-action zone) shall be provided under fire alarm work.
2) Division 21 shall provide pre-action control panel and interconnection between nearest suitable fire alarm panel and location of pre-action valve(s).

2. Temperature control panels, control air compressors and line voltage power for 24v control transformers. Required connections are included in Division 23 and will be shown by that contractor's control submittal drawings.

1.5 GENERAL REQUIREMENTS

A. Remote Switches and Pushbutton Stations:
   1. Provide remote switches and/or pushbutton stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.

B. Special Requirements:
   1. Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

C. Identification:
   1. Provide identification of purpose for each switch and/or pushbutton station furnished. Identification may be either engraved plastic sign permanently mounted to wall below switch, or stamping on switch cover proper. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate area.

D. Control Voltage:
   1. Maximum allowable control voltage 120V. Fully protect control circuit conductors in accordance with National Electrical Code.

E. DDC Control Interface:
   1. Fully coordinate the requirements of each division with regard to supplying a complete DDC Control System prior to submitting bid.
   2. All control power shall be furnished via dedicated line voltage circuits.
   3. Low voltage wiring from J-boxes to distributed control components, all low voltage connections, all control panels and all control transformers (not part of unitary equipment) shall be provided under Division 23.
   4. Any additional power requirements shall be the responsibility of the Division 23 Contractor requiring same, and provided at no additional cost to the owner.

1.6 CEILING AND CHASE CAVITY PRECEDENCE

A. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of precedence. A system with higher precedence may direct that systems of lower precedence be relocated from space, which is required for expeditious routing of the precedent system.

1. Plumbing waste, cooling coil drain piping, and roof drain mains and leaders.
2. Steam and condensate piping.
3. Hydronic main piping (12" and larger).
4. Plumbing vent piping.
5. Supply, return and exhaust ductwork.
6. Electrical conduit greater than 4" diameter.
7. Hydronic branch and mains (greater than 2", but less than 12").
8. Domestic water piping.
9. Fire sprinkler mains and leaders.
10. Hydronic branch piping (2" and less).
11. Domestic hot and cold water branches.
12. Electrical conduit branch feeders.
13. Pneumatic control piping.
14. Fire sprinkler branch piping and sprinkler runouts.

B. Light fixtures have precedence in a zone, which is the same height above the ceiling as the depth of the fixture (plus 2").

C. Examine the contract documents of all trades (e.g. all Division 21, 22, 23, 26 and 28 drawings, the architectural floor plans, reflected ceiling plans, elevations and sections, structural plans and sections, etc.).

D. Coordinate necessary equipment, ductwork and piping locations so that the final installation is compatible with the materials and equipment of the other trades.

E. Prepare shop drawings for installation of all new work before installation to verify coordination of work between trades.

F. Provide access doors for all equipment, valves, clean-outs, actuators and controls which require access for adjustment or servicing and which are located in otherwise unaccessible locations.

1. For equipment located in “accessible locations” such as lay-in ceilings: Locate equipment to provide adequate service clearance for normal maintenance without removing architectural, mechanical, electrical or structural elements such as the ceiling support system, electrical fixtures, etc. “Normal maintenance” includes, but is not limited to: filter changing; greasing of bearings; using p/t ports for pressure or temperature measurements; and replacement of ballasts, fuses, etc.

PART 2 – PRODUCTS

2.1 MOTOR HORSEPOWER

A. In general, all motors ¾ HP and above shall be three phase, all motors ½ HP or less shall be single phase.

B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or general condition 2.1. A., above.
C. Work under Divisions 21, 22 or 23 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Division 26, before ordering the equipment.

1. If motor horsepowers are changed under the work without a change in duty of the motor's driven device, coordination of additional electrical work (if any) and additional payment for that work (if any) shall be provided under the section of that Division initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Architect/Engineer.

PART 3 - EXECUTION - (Not Used)

END OF SECTION 230501/260501
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section supplements Division 1 - General Requirements.

B. Where contradictions occur between this Section and Division 1, the most stringent of the two shall apply. Architect/Engineer shall decide which is most stringent.

C. Provisions of this section shall also apply to all sections of Divisions 21 through 23.

1.2 DEFINITIONS

A. The definitions of Division 1 and the General Conditions of this specification also apply to Divisions 21 through 23 contract.

B. "Contract Documents" constitute the drawings, specifications, general conditions, project manuals, etc., prepared by Engineer (or other design professional in association with Engineer) for contractor's bid or contractor's negotiations with the Owner. Divisions 21 through 23 drawings and specifications prepared by the Engineer are not construction documents.

C. "Construction Documents", "construction drawings", and similar terms for Divisions 21 through 23 work refer to installation diagrams, shop drawings and coordination drawings prepared by the contractor using the design intent indicated on the Engineer's contract documents. These specifications detail the contractor's responsibility for "Engineering by Contractor" and for preparation of construction documents.

D. "(N)" indicates "new" equipment to be provided under this contract.

E. "(E)" indicates "existing" equipment on site which may or may not need to be relocated as a part of this work.

F. "(R)" indicates existing equipment to be relocated as part of this work.

G. "Furnish" means to "supply" and usually refers to an item of equipment.

H. "Install" means to "set in place, connect and place in full operational order".

I. "Provide" means to "furnish and install".

J. "Equal" or "Equivalent" means "meets the specifications of the reference product or item in all significant aspects." Significant aspects shall be as determined by the Architect/Engineer.

K. "Work by other(s) divisions"; "re:_____ Division", and similar expressions means work to be performed under the contract documents, but not necessarily under the division or section of the work on which the note appears. It is the contractors sole responsibility to coordinate the work of the contract between his/her suppliers, subcontractors and employees. If clarification is required, consult Architect/Engineer before submitting bid. By inference, any reference to a "contractor" or "sub-contractor" means the entity, which has contracted with the Owner for the work of the Contract Documents.
L. By inference, any reference to a “contractor” or “sub-contractor” means the entity, which has contracted with the owner for the work of the Contract Documents.

M. "Engineer" means the design professional firm, which has prepared these contract documents. All questions, submittals, etc. of this division shall be routed to the Engineer (through proper contractual channels).

1.3 COORDINATION WITHIN DIVISIONS 21 THROUGH 23

A. Contract Documents:

1. General: The Contract Documents are diagrammatic showing certain physical relationships, which must be established within the Divisions 21 through 23 work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.

2. Supplemental Instructions: The exact location for some items in this Specification may not be shown on the Drawings. The location of such items may be established by the Architect/Engineer during the progress of the work.

3. Discrepancies:
   a. Examine Drawings and Specifications of all Divisions of the work.
   b. Report any discrepancies to the Architect/Engineer and obtain written instructions before proceeding.
   c. Should there be a conflict within or between the Specifications or Drawings, the most stringent or higher quality requirements shall apply.
   d. Items called for in either specifications or drawings shall be required as if called for in both.

4. Constructability:
   a. Examine Drawings and Specifications of all Divisions of the work.
   b. Report any issues to the Architect/Engineer which may prevent installation of Divisions 21 through 23 work in accordance with the Contract Documents and the original construction contract.
   c. Report all issues within 90 days after contract.

B. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service. This coordination shall include, but not be limited to the following:

1. Division 21 - Series contractor (Fire Protection Contractor) shall provide shop drawings to all other Division 21 through 23 contractors.

2. Division 23 09 00 and 23 05 93 - Contractors (Automatic Temperature Controls, Building Management and Test-Adjust-Balance Contractors) shall be provided with equipment product data and shop drawings as appropriate from other Division 21 through 23 and Divisions 26 through 28 contractors, and shall furnish the same information about control devices (such as valves, test wells, etc.) to the appropriate Divisions 21 through 23 Contractor.
C. Coordination Drawings:

1. Submit coordination drawings for all Divisions 21 through 23 work. The drawings shall be fully coordinated and signed off by all affected trades prior to submission. The coordination drawings shall include the following at a minimum.

   a. All major ductwork, piping, conduit and equipment.
   b. Reflected ceiling plans with light fixtures.
   c. Current architectural floor plans.
   d. Major structural elements.
   e. Elevations of piping ductwork or equipment.
   f. Sections through critical spaces.

2. The drawings shall be at a suitable scale (1/8”=1'-0” minimum) to clearly show information.
3. Any work installed without approved coordination drawings is done at the Contractor’s risk.

1.4 COORDINATION WITH OTHER DIVISIONS

A. General:

1. Coordinate Divisions 21 through 23 work to the progress of the work of other trades.
2. Complete the entire installation as soon as the condition of the building will permit.
3. The project will be constructed under multiple bid packages. Coordinate this Division’s work with the progress of the other bid package’s work.

B. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order:

1. Plumbing waste, cooling coil drain, piping and roof drain mains and leaders.
2. Steam and condensate piping.
3. Hydronic main piping (6” and larger).
4. Plumbing vent piping.
5. Supply, return and exhaust ductwork.
6. Electrical conduit greater than 4” diameter.
7. Hydronic branch and mains (greater than 2”, but less than 6”).
8. Domestic water piping.
9. Fire sprinkler mains and leaders.
10. Hydronic branch piping (2” and less).
11. Domestic hot and cold water branches.
12. Electrical conduit branch feeders.
13. Compressed air piping.
14. Fire sprinkler branch piping and sprinkler runouts.

C. Coordination with Electrical Work. Refer to Section 23 05 01.

D. Cutting and Patching: Refer to Division 1 and Section 23 05 03.

E. Chases, Inserts and Openings:

1. Provide measurements, drawings, and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
2. Check sizes and locations of openings provided.
   a. Any cutting and patching made necessary by failure to provide measurements, drawings, and layouts at the proper time shall be done at no additional cost to the Owner.
   b. Coordinate roof openings for all roof-mounted equipment. Openings on documents are diagrammatic and do not represent manufacturer specific requirements. Actual opening size, orientation and location, as well as structural coordination, is the responsibility of the mechanical contractor.
   c. Provide transitions on ductwork to accommodate actual roof openings.

F. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other Sections of the Specifications can be built at the proper time.

1.5 ENGINEERING BY CONTRACTOR

A. The construction of this building requires the contractor to design several systems or subsystems. All such designs shall be the complete responsibility of the contractor.

B. Systems or subsystems which require engineering responsibility by the contractor include, but are not limited to:
   1. Any system not fully detailed on the drawings.
   2. Fire sprinkler.
   3. Equipment supports, and hangers not fully detailed in the drawings.
   4. Pipe hangers and anchors not specified in these documents, or cataloged by the manufacturer.
   5. Duct supports, hangers and miscellaneous steel as required.
   6. Temperature controls.
   7. Refrigeration systems.
   9. Equipment supports, hangers.

1.6 REGULATORY REQUIREMENTS

A. Codes: Comply with the following (refer to Division 1 for publication years):
   2. International Mechanical Code.
   5. ASME Boiler and Pressure Vessel Code.
   6. Local Modifications to above Codes.

B. Applicable pamphlets of NFPA.
C. Requirements of Local Utility Companies:
   1. Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required for the project.

D. Other Regulations: Comply with the latest editions of the following:
   1. U.S. and State Department of Labor Safety Regulations pertaining to the completed project.
   2. Requirements of Fire Departments serving the project.
   3. Regulations of the Health Department having jurisdiction.
   4. Regulations of the Office of State Fire Marshal.
   5. ASHRAE Energy Conservation Standard 90A.
   7. Requirements of the State Oil Inspector.
   8. Americans with Disabilities Act (ADA).
   12. University of Colorado Boulder Standards July 2008. These standards shall complement these specifications and are part of the Contract Documents.

E. Additional Regulations: Follow additional regulations, which appear in individual Sections of these Specifications.

F. Contradictions: Where codes are contradictory, follow the most stringent, unless otherwise indicated in Plans or Specifications. Architect/Engineer shall determine which is most stringent.

G. Contract Documents Not in Compliance:
   1. Where the Drawings and Specifications do not comply with the minimum requirements of the Codes, either notify the Architect/Engineer, in writing during the Bidding Period, of the revisions required to meet Code requirements, or provide an installation which complies with the Code requirements. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
   2. Follow Drawings and Specifications where they are superior to Code requirements.

H. Permits:
   1. Obtain all permits required by authorities and agencies having jurisdiction for the work of this Division.
   2. Post permits as required.

I. Inspections and Tests:
   1. Arrange for all required inspections and tests.
   2. Pay all charges.
   3. Notify Architect/Engineer 48 hours before tests.
   4. Submit one copy for Owners records of permits, licenses, inspection reports and test reports.
   5. Contractor shall make himself/herself aware of all UCB requirements for testing and inspections. Comply with processes required by UCB inspectors.
1.7 RECORD DRAWINGS

A. General Recording Procedure:

1. Maintain a blue-line set of Divisions 21 through 23 Contract Drawings in clean, undamaged condition, for mark-up of installations, which vary, substantially from the Contract Drawings.

2. Record changes drawn to scale and fully dimensioned, as specified in Division 1.
   a. Work concealed behind or within other work, in an inaccessible arrangement.
   b. Mains and branches of piping systems:
      1) with valves and control devices located and numbered.
      2) with concealed unions located.
      3) with items requiring maintenance located (traps, strainers, expansion compensators, tanks, etc.).
   c. Underground piping and ducts, both exterior and interior.
   d. Ductwork layouts, including locations of coils, dampers, filters, boxes and similar units.
   e. Concealed control system devices and sensors.

B. Corrected Drawings:

1. Obtain a set of contract drawings on CAD.
2. Update the CAD files to reflect as-built conditions.
3. Transmit corrected CAD files and plots as a submittal to the Architect/Engineer for Owner’s use and record.

C. Temperature Control Drawings:

1. Indicate as-built conditions of work under this contract including:
   a. Ladder wiring diagram.
   b. Pneumatic schematic diagrams.
   c. One line system diagram.
   d. Control schematic of equipment with control devices located and identified.
   e. Wiring or tubing termination diagrams.
   f. List of materials.
   g. Floor plan indicating all device locations.
   h. Control sequences.
   i. Indicate electrical power source for each point of connection to the electrical system.

2. Reproducible temperature control drawings shall be delivered to the Architect/Engineer prior to Owner’s acceptance of project.

1.8 OPERATING AND MAINTENANCE DATA

A. Refer to Division 1 for additional requirements.
B. Submission:

1. Submit electronic files of Operating and Maintenance Manuals prior to scheduling systems demonstration for the Owner, as specified in Division 1. Files are due for review 30 days after final review of equipment submittals.

2. Bind each Maintenance Manual in one or more vinyl covered, 3-ring binders, with pockets for folded drawings.
   a. Mark the back spine of each binder with system identification and volume number.

C. Required Contents:

1. Manuals shall have index with tab dividers for each major equipment section to facilitate locating information on specific piece of equipment.

2. Identify data within each section with drawing code numbers as they appear on Drawings and Specifications. Include as a minimum the following data:
   a. Alphabetical list of system components, with the name, address and 24 hour telephone number of the company responsible for servicing each item during the first year of operation. Include point of contact for company.
   b. Operating instructions for complete system including:
      1) Emergency procedures for fire and failure of major equipment.
      2) Major start, operation and shut-down procedures.
   c. Maintenance Instructions for each piece of equipment including:
      1) Equipment lists.
      2) Proper lubricants and lubricating instructions for each piece of equipment.
      3) Necessary cleaning, replacement and/or adjustment schedule.
      4) Product Data.
      5) Installation instructions.
      6) Parts lists.
      7) Complete wiring diagrams.
   d. Temperature control diagrams and O&M information as specified above (as-built).
   e. Marked or changed prints locating concealed parts and variations from the original system design (as-built drawings).
   g. Valve schedule and associated piping schematics. See Division 23 05 53, Mechanical Identification.
   h. Copies of any extended equipment warranties, which are greater than one year.

D. Identify all starters, disconnect switches, and manually operated controls, except integral equipment switches with permanently applied, legible markers corresponding to operating instructions in the “Operation and Maintenance Manual”. Coordinate with University Preventive Maintenance personnel.

E. Contractor shall be responsible for scheduling instructional meetings for maintenance personnel on the proper operation and maintenance of all mechanical systems, using the “Operation and Maintenance Manual” as a guide.
1.9 WARRANTIES

A. The warranty period is one year after Date of Acceptance.

1. During this period, provide labor and materials as required to repair or replace defects in the mechanical system at no additional cost to the Owner. Provide certificate with O&M manual submittal which guarantees same-day service response to Owners call for all such warranty service.

2. Provide certificates for such items of equipment which have warranties in excess of one year. Insert copies in O&M manuals. Such equipment shall include:

   a. Temperature Control Valves five (5) years.
   b. Variable frequency drives 3 years.

3. Provide extended manufacturers warranties to cover one full year from date of acceptance if standard warranty starts any time prior to that date.

4. Provide factory trained service personnel for all warranty work on the DDC Control System and the following equipment:

B. Refer to Division 1 for additional requirements.

1.10 SCOPE

A. The Contractor shall:

1. Supply all labor, transportation, materials, apparatus, light, and tools necessary for the completion of the mechanical work.

2. Install, maintain, and remove all construction equipment.

3. Be responsible for safe, lawful, and proper construction maintenance.

4. Construct, in the best and most workmanlike manner, a complete project and everything properly incidental thereto, as shown on the Drawings, as stated in the Specifications, or reasonably implied there from, all in accordance with the Contract documents.

5. Refer to Division 1 for additional requirements.

1.11 MANDATORY GOVERNING PROVISION

A. Omissions of words or phrases, such as “the Contractor shall,” “in conformity with,” “shall be,” “as noted on the Drawings,” “according to the Drawings,” “an,” “the,” and “all,” are intentional.

B. Omitted words or phrases shall be supplied by inference.

1.12 PROTECTION OF PROPERTY AND MATERIALS

A. Provide protection against dust migration, rain, wind, storms, frost, or heat, so as to maintain all work, materials, apparatus, and fixtures free from injury or damage.

B. At end of each day’s work, cover all new work likely to be damaged.

C. Do not interrupt the integrity of the building security overnight.

D. Refer to Division 1 for additional requirements.
1.13 OWNER FURNISHED EQUIPMENT

A. All equipment called out in the Specifications or shown on the Drawings as “Owner-Furnished Equipment” shall be installed and connected under this Contract. Provide rough-ins for all future connections indicated.

1.14 TEMPORARY FACILITIES

A. Light, Heat, Power, etc.

   1. Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.
   2. Contractor shall be responsible for maintaining the equipment in an as-new condition. Equipment will not be turned over to the Owner until it is brought up to as-new condition.
   3. The contractor shall be responsible for maintaining acceptable indoor air quality in adjacent occupied spaces.

B. Use of Permanent Building Equipment for Temporary Heating or Cooling.

   1. Permanent building equipment shall not be used without written permission from the Owner. If this equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer’s instructions and protected with filters, strainers, controls, reliefs, etc. The contractor shall protect all equipment and systems as directed by the engineer. The warranty period shall not start until the equipment is turned over to the Owner for his use. The contractor shall provide extended warranties for parts and labor for all such equipment. Equipment shall not be turned over to the Owner until the temperature controls have been tested and accepted by the Owner and Engineer.

1.15 INSTALLATION GENERAL REQUIREMENTS

A. Furnish, apply, install, connect, erect, clean, and condition manufactured materials and equipment as recommended in manufacturer’s printed directions (maintained on job site during installation).

B. Provide all attachment devices and materials necessary to secure materials together or to other materials.

C. Make allowance for ample and normal expansion and contraction for all building components and piping systems that are subject to such.

D. Install materials only when conditions of temperature, moisture, humidity, and conditions of adjacent building components are conducive to achieving the best installation results.

E. Erect, install, and secure components in a structurally sound and appropriate manner.

F. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.

G. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.

H. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.
I. Conduct work in a manner to avoid injury or damage to previously placed work.

J. Any work so impaired or damaged shall be replaced at no expense to Owner.

K. Fabricate and install materials true to line, plumb, and level.

L. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.

M. Furnish materials in longest practical lengths and largest practical sizes to avoid all unnecessary jointing.

N. Make all joints secure, tightly fitted, and as inconspicuous as possible by the best accepted practice in joinery and fabrication.

O. Consult Engineer for mounting height or position of any unit not specifically indicated or located on Drawings or specified in Specifications.

P. Job mixed multi-component materials used in the work shall be mixed in such regulated and properly sized batches that material can be used before it begins to “set”.

Q. Mixing of a partially “set” batch with another batch of fresh materials will not be accepted and entire batch shall be discarded and removed from site.

R. Clean all mixing tools and appliances that can be contaminated prior to mixing of fresh materials.

S. In addition to the above refer to each Section of the Specifications for additional installation requirements for the proper completion of all work.

PART 2 – PRODUCTS

2.1 QUALITY CONTROL

A. Refer to Division 1 of the Specifications.

B. The manufacturer of equipment or materials listed on the drawings or first named in the specification is the basis of design. If the drawings and specifications are in conflict, the drawings shall take precedence. Other manufacturers listed are considered general equivalents only. See below for coordination of substitutions.

C. Products by manufacturers not listed in this Specification may be submitted to Architect/Engineer during Bidding Period in accordance with Division 1.

D. Products by manufacturers not listed in this Specification may be submitted to the Engineer only during normal submittal procedure, and only as “substitutions”. All bids must use basis of design or listed general equivalents.

E. Any manufacturer not listed shall be considered a substitution.
F. Items submitted as a substitution to the basis of design or listed general equivalents shall be identified as such and shall include a written request for substitution indicating the following:

2. Contract time adjustment.
3. Item by item breakdown of differences between basis of design and substituted item.
4. Operation, maintenance, and energy cost difference.

G. Coordination of general equivalents and substitutions: Where Contract Documents permit selection from several general equivalents, or where substitutions are authorized, coordinate clearance and other interface requirements with mechanical and other work.

1. Provide necessary additional items so that selected or substituted item operates equivalent to the basis of design and properly fits in the available space allocated for the basis of design.
2. Provide all features which are standard on the basis of design.
3. Contractor is responsible for assuring that piping, conduit, duct, flue, and other service locations for general equivalents or substitutions do not cause access, service, or operational difficulties any greater than would be encountered with the basis of design.

2.2 GENERAL SUBMITTAL REQUIREMENTS

A. Refer to Division 1.

B. Coordination and Sequencing:

1. Coordinate submittals 2 weeks (min.) prior to expected order date so that work will not be delayed by submittals.
2. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.
3. Do not submit product data, or allow its use on the project until compliance with requirement of Contract Documents has been confirmed by Contractor.
4. Submittal is for information and record, unless otherwise indicated, and is not a change order request.
5. Submitting contractor is responsible for routing reviewed submittals to all parties affected including but not limited to electrical, temperature control, and test and balance subcontractors.
6. ALL DIVISION 21, 22, AND 23 SUBMITTALS SHALL BE PROVIDED AT ONE TIME FOR REVIEW. SUBMITTALS MAY NOT BE PROVIDED FOR INDIVIDUAL PIECES OF EQUIPMENT WITHOUT PRIOR APPROVAL OF OWNER AND ARCHITECT. LONG LEAD ITEMS WILL BE GIVEN CONSIDERATION FOR INDIVIDUAL SUBMITTALS.

C. Preparation of Submittals:

1. Refer to Division 1 requirements.
2. Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, Supplier, submittal name and similar information to distinguish it from other submittals.
3. Indicate any portions of work which deviate from the Contract Documents.
   a. Explain the reasons for the deviations.
   b. Show how such deviations coordinate with interfacing portions of other work.
4. Show Contractor’s executed review and approval marking.
5. Provide space for Architect’s/Engineer’s “Action” marking.
6. Submittals which are received from sources other than through Contractor’s office will be returned “Without Action”.
7. Submittals shall be presented in a neat and legible fashion and shall be returned “Without Action” if presented in any other fashion.

D. Quantities:
1. Refer to Division 1 requirements.
2. Multiple System Items: Where a required submittal relates to an operation or item of equipment used in more than one system, increase the number of final copies as necessary to complete the Maintenance Manuals for each system.
3. General Distribution:
   a. Provide additional distribution of submittals (not included in foregoing copy submittal requirements) to Subcontractors, Suppliers, Fabricators, Installers, Governing Authorities and others as necessary for proper performance of the work.
   b. Include such additional copies in transmittal to Architect/Engineer where required to receive “Action” marking before final distribution.

   1) Show such distributions on transmittal forms.

E. Response to Submittals: Where standard product data have been submitted, it is recognized:
1. That the Submitter has determined that the products fulfill the specified requirements.
2. That the submittal is for the Architect’s or Engineer’s information only, but will be returned with appropriate action where observed to be not in compliance with the requirements.

F. If more than two submissions (either for shop drawings, as-built drawings, or test and balance reports) are made by the contractor, the Owner reserves the right to charge the contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the contractor.

2.3 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS

A. Manufacturer’s Data:
1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
2. Delete or mark-out significant portions of pre-printed data which are not applicable.
3. Where operating ranges are shown, mark data to show portion of range required for project application.
4. For each product, include the following:
   a. Sizes
   b. Weights
   c. Speeds
   d. Capacities
   e. Piping and electrical connection sizes and locations.
   f. Statements of compliance with the required standards and regulations.
   g. Performance data.
   h. Manufacturer’s specifications and installation instructions.
B. Shop Drawings:

1. Prepare Mechanical Shop Drawings, except diagrams, to accurate scale.
   a. Show clearance dimensions at critical locations.
   b. Show dimensions of spaces required for operation and maintenance.
   c. Show interfaces with other work, including structural support.

2. Controls submittals shall include panel schedules for review by UCB and Architect/Engineer.

C. Test Reports:

1. Submit test reports which have been signed and dated by the firm performing the test.
2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.

D. Required equipment and shop drawing submittals:

1. Provide a submittal schedule with bid.
2. Provide equipment submittals for each item of equipment specified or scheduled in the contract documents.
3. Submittal Schedule shall show each item of equipment, applicable Section of the specifications where it is described, applicable Drawing number and schedule name where it is scheduled, date of Contractor’s proposed submittal to Architect, required date to receive submittal from Architect and schedule order date.
4. Provide a Mechanical Shop Drawing Schedule for submission to the Architect with the Submittal Schedule. Refer to paragraph 1.3 - Coordination Within Divisions 21 through 23 above.

2.4 COMPATIBILITY

A. General: Provide products which are compatible with other products of the mechanical work, and with other work requiring interface with the mechanical work.

B. Altitude Ratings: Except where noted otherwise, all ratings and capacities stated in the Contract Documents are at the altitude of the project, not sea level. Project Altitude shall be considered to be 5400 feet.

C. Fuel Characteristics:

1. Review fuel characteristics with the Fuel Supplier designated by the Owner.
2. Determine burner or combustion equipment provisions needed for optimum performance. Provide equipment accordingly.

D. Power Characteristics:

1. For power characteristics of equipment supplied under Division 21 through 23 Sections, refer to the Sections of Divisions 26 through 28 and the Electrical Drawings for the power characteristics of each power driven item of mechanical equipment.
2. Coordinate available power with Electrical Contractor before ordering equipment. Mechanical Contractor shall be responsible for ordering equipment to meet the available power characteristics.
3. See also Division 23 05 01 of these specifications.
4. If there is a conflict between Divisions 21 through 23 documents and Divisions 26 through 28 documents, alert the engineer. Do not order equipment prior to determining the proper electrical service. No contract cost adjustment will be allowed for equipment ordered in conflict with the available power characteristics.

2.5 SAFETY PROVISIONS

A. Equipment Nameplates: Provide power-operated mechanical equipment with a permanent nameplate attached by the manufacturer, indicating:

1. The manufacturer
2. Product name
3. Model number
4. Serial number
5. Speed
6. Capacity
7. Power characteristics
8. Labels of testing, listing, or inspecting agencies
9. Other similar data

B. Where manufacturer affixed nameplate is not available, Mechanical Contractor shall fabricate and attach nameplate.

C. Guards:

1. Unless equivalent guards are provided integral with the equipment, enclose each belt drive (including sheaves) on both side in a galvanized, one inch, mesh screen of No. 18 gauge steel wire or expanded metal, fastened to an approved, structural steel frame, securely fastened to the equipment or floor.
2. Provide tachometer holes at shaft centers. Unless equivalent guards are provided integral with the equipment, install a solid guard of No. 20 gauge galvanized steel over the coupling of each item of direct-driven equipment.
3. Sides are not required on these guards except to ensure rigidity.

2.6 SAFETY PROVISIONS

A. Any refrigeration system containing refrigerants listed in the Clean Air Act as a Class I or Class II Ozone Depleting Compound shall comply with the Clean Air Act and the Colorado Air Quality Control Commission Regulation #15.

B. As a minimum all systems shall be equipped with refrigerant recovery service valves, relief valves capable of resetting after activation, and for system with more than 50 pounds of charge, and isolatable receiver and/or condenser capable of holding the complete charge.
PART 3 – EXECUTION

3.1 COORDINATION OF MECHANICAL INSTALLATION

A. Inspection and Preparation:

1. Examine the work interfacing with mechanical work, and the conditions under which the work will be performed, and notify the Architect/Engineer of conditions detrimental to the proper completion of the work at original contract price.
2. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Layout:

1. Layout the mechanical work in conformity with the Contract Drawings, Coordination Drawings and other Shop Drawings, product data and similar requirements so that the entire mechanical plant will perform as an integrated system, properly interfaced with other work, recognizing that portions of the work are shown only in diagrammatic form.
2. Where coordination requirements conflict with individual system requirements, comply with the Architect’s or Engineer’s decision on resolution of the conflict.
3. Take necessary field measurements to determine space and connection requirements.
4. Provide sizes and shapes of equipment so the final installation conforms to the intent of the Contract Documents.

C. Integrate mechanical work in ceiling spaces with suspension system, light fixtures and other work so that required performances of each will be achieved.

3.2 PRODUCT INSTALLATION

A. Manufacturer’s Instructions:

1. Except where more stringent requirements are indicated, comply with the product manufacturer’s instructions and recommendations.
2. Consult with manufacturer’s technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
3. If a conflict exists, notify the Architect/Engineer in writing and obtain his instruction before proceeding with the work in question.

B. Movement of Equipment:

1. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed.
2. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of equipment.

C. Heavy Equipment:

1. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.
2. Where mechanical products to be installed on the existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.
D. Return Air Path: Coordinate mechanical work in return air plenum to avoid obstructing return air path.

1. Do not make changes in layout which will reduce return air path cross-sectional areas. Minimum cross-sectional area will provide an average of 500 fpm and a maximum of 750 fpm velocity through return air plenum at specified supply air quantity unless otherwise noted.
2. Provide openings in any full height walls to allow for free movement of return air. Openings are to be sized for 500-750 fpm velocity. Notify the Architect/Engineer for any openings required in fire rated walls that are not shown on the contract drawings.
3. Report any obstructions by work of other Divisions to Architect/Engineer.

E. Clearances:

1. Install piping and ductwork:
   a. Straight and true.
   b. Aligned with other work.
   c. Close to walls and overhead structure (allowing for insulation).
   d. Concealed, where possible, in occupied spaces.
   e. Out-of-the-way with maximum passageway and headroom remaining in each space.
2. Except as otherwise indicated, arrange mechanical services and overhead equipment with a minimum of:
   a. 7’0” headroom in storage spaces.
   b. 8’6” headroom in other spaces; where approved by Architect.
3. Do not obstruct windows, doors or other openings.
4. Give the right-of-way to piping or duct systems required to slope for drainage (over other service lines and ductwork).

F. Access:

1. Provide for removal, without damage to other parts, of:
   a. Coils
   b. Tubes
   c. Shafts
   d. Fan wheels
   e. Drives
   f. Filters
   g. Strainers
   h. Bearings
   i. Control components
   j. Other parts requiring periodic replacement or maintenance
2. Connect equipment for ease of disconnecting with minimum of interference with other work.
3. Provide unions where required.
4. Locate operating and control equipment and devices for each access.
5. Provide access panels where units are concealed by non-accessible finishes and similar work. See Section 23 05 03.
6. Extend all grease fittings to an accessible location.
3.3 PROTECTION OF WORK

A. All pipe ends, valves, ducts, and equipment left unconnected shall be capped, plugged or otherwise properly protected to prevent damage or the intrusion of foreign matter.

B. Do not allow any fans in the HVAC system to operate before the area served by the fan has been cleaned and vacuumed of all debris and dust which might enter the system.

C. Any equipment, duct or piping systems found to have been damaged or contaminated above “MILL” or “SHOP” conditions shall be replaced or cleaned to the Engineer’s satisfaction.

D. Initial fill of traps:
   1. Provide initial water seal fill for all waste P-traps, condensate traps, or similar traps.

3.4 PROTECTION OF POTABLE WATER SYSTEMS

A. All temporary water connections shall be made with an approved back flow preventer.

B. All hose bibs shall have as a minimum, a vacuum breaker, to prevent back flow.

C. Direct connections to hydronic systems shall only be made through a reduced pressure back flow preventer.

3.5 REFRIGERATION SYSTEMS

A. All techniques involved in the installation of refrigeration systems shall be certified and trained in accordance with the State of Colorado, and the applicable sections of the Clean Air Act.

B. No refrigerant shall be intentionally vented to the atmosphere. All refrigerant shall be recovered before opening a closed system for charging, evacuation, service or installation.

3.6 START-UP

A. Assign a full time Divisions 21 through 23 Start-Up Coordinator to this project.

B. The Start-Up Coordinator shall develop detailed start-up procedures, equipment checkout procedures and data forms for recording compliance with contract document performance criteria, and will assist in developing schedules for checkout and Owner acceptance.

C. The Divisions 21 through 23 Contractor shall include as part of the work of this contract, manpower, equipment, tools, ladders, instruments, etc. necessary to confirm start-up of Divisions 21 through 23 systems.

D. The Division 23 05 93, Test, Adjust and Balancing Contractor shall include as part of the work of his/her contract, labor and material to provide manpower, equipment, tools, ladders, instruments, etc. necessary to assist the Start-Up Coordinator in accomplishing his/her work.

E. The Start-Up Coordinator shall be responsible for maintaining documentation of Start-Up activities until final acceptance of the project.
F. The documentation shall be kept current by the Start-Up Coordinator and shall be available for inspection at all times. At the time of acceptance of the project, the Start-Up Coordinator shall surrender 3 completed copies of the documentation to the Owner’s representative.

G. Before Testing, Adjusting, Calibration and Balancing (Division 23 05 93), the Start-Up Coordinator shall confirm, in writing to the Owner, the following:

1. All equipment, components, and systems have been set, started-up, and adjusted.
2. Systems have been established at the appropriate temperatures and pressures for proper operation and performance.
3. All electric power connections, disconnects, fuses, circuit breakers, etc. are properly sized and installed.
4. The operation of all valves, dampers and sensors is positive (per the control sequences) and demonstrated.

H. Provide dated matrices for each item of equipment showing the date each of the start-up activities was witnessed or performed by the Start-Up Coordinator.

1. Start-up and operating performance test documentation shall include all Division 21 through 23 equipment with scheduled capacities and all Division 23 09 00 equipment.

I. At the completion of the start-up; and test and balance, Divisions 21 through 23 shall conduct a 72 hour dynamic mode demonstration of the systems in the presence of the Owner and Architect/Engineer.

3.7 DEMONSTRATION

A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings and Operation and Maintenance Manual submittal and systems demonstration.

1. Demonstrate to the Architect/Engineer that each system operates in accordance with the contract documents.
2. Explain the operation of each system to the Owner’s Representative. Explain use of O&M manual in operating and maintaining systems.

B. Date and time of demonstration will be determined by Owner.

3.8 PROJECT CLOSEOUT

A. Refer to the individual sections of the specifications for individual closeout requirements.

B. Provide a written schedule of when systems are to be started up, tested and demonstrated along with dates for completion of the temperature controls and balancing. This schedule shall be submitted no later than 30 days prior to starting up and testing equipment.

C. The contractor shall notify the Architect/Engineer no later than 2 weeks in advance of system testing or demonstration.
3.9 JOURNEY MAN TO APPRENTICE RATIO

A. The University requires that all plumbing and pipe fitting work be performed under the direct supervision of a licensed plumber (4-years), with a ratio of not more than 2 apprentices per journeyman.

B. Steam fitters shall have a City and County of Denver journeymen steam fitters certification.

END OF SECTION 230502
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. This Section supplements Division 1, General Requirements.
   B. Where contradictions occur between this Section and Division 1, the most stringent of the two shall apply. The Architect design team shall decide which is most stringent.
   C. Provisions of this Section shall also apply to all Sections of Divisions 21 through 23.

1.2 SUBMITTALS
   A. Manufacturer’s Data - Submit manufacturer’s data for:
      1. Access panels.
      2. Fire stopping materials.
   B. Application Data - Submit application data for firestopping materials showing UL required installation details for every combination of pipe material, penetrated structure, opening size and required fire rating within the scope of this project. Application data drawings shall include UL system number.

PART 2 – PRODUCTS

2.1 ACCESS PANELS
   A. See Division 8 for access panel types and finishes.
      1. If panels are not specified in Division 8, comply with the following:
         a. Manufacturers:
            1) Design Basis: Milcor Division, Iryco, Inc.
            2) Other Acceptable Manufacturers:
               a) Birmingham Ornamental Iron Co.
               b) Karp Associates, Inc.
               c) Wilkenson Co., Inc.
               d) Zurn.
      B. Construction:
         1. Doors: 14 gauge steel.
         2. Frames: 16 gauge steel.
         3. Fire Rating: Equivalent to construction in which installed.
         4. Latches: Flush or concealed, ¼ turn.
         5. Finish: Compatible with finish of construction in which installed.
         6. Sizes and locations shall be adequate to provide access to all components.
2.2 FIRE STOPPING MATERIAL

A. Manufacturers:
   1. Design Basis: 3M.
   2. Other acceptable manufacturers:
      a. GE
      b. Metalines
      c. Hilti

B. General Requirements:
   1. Products to be used shall have been tested in accordance with ASTM E 814-88, and be listed in the UL Fire Resistance Directory.

C. Bare Piping:

D. Insulated Piping:
   2. “No-sag” or “self-leveling” as required.

E. Plastic Piping:
   2. “No sag” or “self-leveling” as required.

F. Accessories:
   1. Provide fasteners, restricting collars, backing materials, and protective coatings as required to comply with the UL system listing.

PART 3 – EXECUTION

3.1 CUTTING AND PATCHING

A. Refer to Division 1 of the Specifications.

B. General: Provide measurements, drawings and layouts to installers of other work so that required openings may be provided as construction progresses. Any cutting and patching made necessary by failure to provide this information shall be done at no increase in the contract amount.

C. General: All cutting and patching of existing work required for work of Divisions 21 through 23 is included in Divisions 21 through 23.

D. Where possible, mark openings to be cut on existing construction. Otherwise, provide measurements, drawings and layouts to the trade doing the cutting so that openings may be provided as construction progresses.
E. Cutting Concrete:
   1. Where authorized, cut openings through concrete for pipe penetration and similar services by core drilling or sawing.
   2. Do not cut by hammer-driven chisel or drill.

F. Cutting:
   1. Cut openings in accordance with layouts, measurements or drawings of the Installer of work requiring openings. Cut openings in concrete by core drilling or sawing; not by hammer-driven chisel or drill.
   2. Coordinate the location of all openings with structural drawings. Report any discrepancies to Architect. Do not proceed with work until discrepancies have been resolved.
   3. Do not endanger or damage other work through the procedures and processes of cutting to accommodate mechanical work.
   4. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage.
   5. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

G. Patching:
   1. Where patching is required to restore other work because of either cutting or other damage inflicted during the installation of mechanical work, engage experienced craftsmen to complete the patching of the other work.
   2. Restore the other work in every respect, including the elimination of visual defects in exposed finishes.
   3. All openings in fire rated construction shall be patched and sealed with U.L. approved sealant to maintain the fire integrity of the structure.

H. Perform cutting, and patching required to:
   1. Uncover work to provide installation of ill-timed work.
   2. Remove and replace defective work.
   3. Remove and replace work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineers observation of concealed work.

I. Painting:
   Paint all surfaces marred by cutting and/or patching to match existing.
   1. Engage experienced painters.
   2. Comply with requirements of Painting Sections of this Specification.

J. Structural Limitations:
   1. Do not cut or drill into structural framing, walls, floors, decks, and other members intended to withstand stress, except with Engineer’s written authorization.
      a. Provide lintels, columns, braces and other temporary and permanent supports made by cutting.
b. Submit shop drawings of permanent supports.
c. Do not penetrate legs of structural "T's" or any other location where pre-stressed structural chords are likely to be encountered when cutting or drilling.

3.2 ACCESS PANELS

A. Furnish access panels where indicated and at locations where required for access to:
   1. Concealed valves
   2. Dampers
   3. Control devices
   4. Equipment servicing
   5. Shock arresters
   6. Air vents
   7. Flow measuring and balancing stations
   8. Any other device or item equipment requiring maintenance, adjustment or service.

B. Deliver access panels for installation by the trade responsible for surface in which installed.
   1. Provide instructions for location.
   2. The minimum size for access doors shall be the larger of 24"x24" or to fit the size of equipment to be removed.

3.3 SLEEVES

A. Provide sleeves for piping passing through walls, floors and roofs.

B. Set pipe sleeves and inserts in place before concrete is poured. Coordinate the placing of these items to avoid delaying concrete placing operations.

C. Locate chases, shafts, and openings required for the installation of the mechanical work during framing of the structure. Do any additional cutting and boring required due to improperly located or omitted openings without cost to the Owner under the supervision of the Owner's representative.

D. Size sleeves for below grade pipe a minimum of 2” beyond outside of pipe.

E. Coat surface of all sleeves in contact with concrete, masonry or soil with two coats of coal tar bitumastic paint.

F. Provide Sleeves as Follows:

<table>
<thead>
<tr>
<th>Sleeve Location</th>
<th>Sleeve Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Stud Partition Walls</td>
<td>Adjustable galvanized sheet metal with wall flanges and plaster lip, 2” and smaller – 22 gauge, 3” through 6” – 20 gauge, 8” and larger – 18 gauge.</td>
</tr>
<tr>
<td>Membrane Waterproof Floor and Roof Construction</td>
<td>Galvanized cast iron body with flashing clamp, threaded for sleeve riser. (J.R. Smith 1760 or equivalent by Ancon, Zurn or Josam).</td>
</tr>
<tr>
<td>Nonmembrane Floor, Construction</td>
<td>Non-adjustable galvanized sheet metal with deck flange and end cap, 2” and smaller – 22 gauge, 3” – 20 gauge, 4” and larger – 16 gauge.</td>
</tr>
</tbody>
</table>
### SECTION 230503 BASIC MECHANICAL MATERIALS AND METHODS

#### Sleeve Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Walls Below Grade</td>
<td>Standard weight galvanized steel pipe with a continuously welded water stop of ( \frac{1}{4} )&quot; steel plate extending from outside of sleeve a minimum of 2&quot; all around. Provide modular mechanical–type seal consisting of interlocking synthetic rubber links with bolts shaped to continuously fill the annular space between the pipe and sleeve. Thunderline Corporation “Link-Seal” sealant assembly or equal by Metraflex “MetaSeal”.</td>
</tr>
<tr>
<td>Floors of Mechanical Rooms, Concrete Walls or Masonry Walls Above Grade</td>
<td>Standard weight galvanized steel pipe.</td>
</tr>
</tbody>
</table>

#### Sleeve Material

- **Location**
- **Sleeve Length**
- **Floors**
  - Equal to depth of floor construction including finish. Refer to Section 230522 for required heights above slab.
- **Roofs**
  - Equal to depth of roof construction including insulation.
- **Walls**
  - Equal to depth of construction.

#### 3.4 FIRE STOPPING

- **A.** Install firestopping materials in accordance with their UL and ASTM tested methods.

- **B.** Coordinate required annular space with size of pipe and sleeve. Refer to Section 23 05 22.

- **C.** Requirements for specific systems:
  1. Cold piping - includes chilled water, domestic water, storm water and refrigerant: Insulation and vapor barrier shall be continued through wall and firestopping for “insulated piping” shall be provided.
  2. Hot piping - to 250°F -includes domestic hot water, steam to 15 psig and heating hot water: The Contractor has the option of continuing the insulation through the penetration and providing firestopping for “insulated piping”, or stopping the insulation on either side of the penetration and using firestopping for “ uninsulated piping”.
  3. High temperature piping, over 250°F or over 15 psig steam: Contractor shall stop insulation and provide firestopping for “high temperature piping”.

#### 3.5 EQUIPMENT BASES AND SUPPORTS

- **A.** Supporting Steel: Provide supporting steel not indicated on the Structural Drawings for equipment, pipe, ductwork, and other pieces of this Division’s work requiring same.
  1. Submit shop drawings and structural calculations to the Engineer for information and records.
  2. Brace and fasten with flanges bolted to structure.
  3. Paint supporting steel with one coat of primer paint in the shop after fabrication welding is complete. Paint completed field joints with one coat of matching primer.
B. Housekeeping Bases:
   1. Concrete bases for pumps, boilers, tanks, fans, etc., including anchor bolts and inserts, will be provided in accordance with American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) Standards for housekeeping pads and equipment support bases.
   2. The concrete shall be placed in accordance with setting diagrams and sizes furnished by the equipment installer.

3.6 DRIP PANS
A. Drip Pans:
   Where possible to run mechanical piping elsewhere, do not run mechanical piping directly above electrical (or electronic) work which is sensitive to moisture. Otherwise, provide drip pans under mechanical piping, sufficient to protect electrical work from dripping.
   1. Locate pan immediately below piping, and extend a minimum of 6” on each side of piping and lengthwise 18” beyond equipment being protected.
   2. Fabricate pans 2” deep of reinforced sheet metal with rolled edges and soldered or welded seams; 22 gauge galvanized steel.
   3. Provide ¾” copper drainage piping from pan to nearest floor drain or similar suitable point of discharge, and terminate pipe as an open-sight drainage connection.
   4. Provide permanent support and anchorage to prevent displacement of drip pans.
   5. Insulate bottom of pan as directed by Engineer.

END OF SECTION 230503
PART 1 - GENERAL

1.1 SUBMITTALS

A. Submit manufacturer’s product data.

1. Motors: Identify by unit served. Include:
   a. Voltage
   b. Phase
   c. Horsepower
   d. Frame
   e. Insulating class
   f. Efficiency
   g. Power factor
   h. Index number
   i. Speed
   j. Starting characteristics

2. Starters: Identify by motor served. Include:
   a. Enclosure, NEMA Type
   b. NEMA size
   c. Accessories, switches, transformers, etc.
   d. Wiring diagram
   e. Auxiliary contacts
   f. Thermal overload size

3. Submit as part of packaged unit submittals when purchased as part of item of equipment.

1.2 SINGLE MANUFACTURER

A. Provide all motors, except those factory mounted, by a single manufacturer.

B. Provide all starters, except those factory mounted, by a single manufacturer.

C. “Factory mounted” means “as part of a packaged unit” where the motor is not purchased separately from the driven equipment.

PART 2 - PRODUCTS

2.1 MOTORS

A. Manufacturers:

1. Acceptable Manufacturers:
   a. General Electric
   b. Westinghouse
   c. Reliance
d. ABB  
e. Louis Allis  
f. Toshiba

2. Factory mounted motors may be by equipment manufacturer’s standard supplier.

B. Bearings: Ball bearings, grease lubricated with grease fittings.

C. Enclosure: As required by location.

D. Service Factor: 1.15.

E. Full-Load Operation: At 105°F and altitude of project.

F. Insulation:
   1. Constant Speed: Class B.  
   2. Variable Frequency Controlled: Class F.

G. Efficiency Ratings:
   1. All motors one horsepower and larger, except as noted, shall be premium efficiency motors, in accordance with NEMA Standard MGI-2003, Tables 12-12 and 12-13.  
   2. All motors greater than 1000 Watts shall have a power-factor of not less than 85%.

H. Electrical Characteristics:
   1. Refer to sections 230501, Mechanical and Electrical Coordination.  
   2. Motors ½ hp and smaller shall be 115-volt single phase.  
   3. Motors ¾ hp and larger shall be three phase, of voltage shown in Electrical Section of Contract Documents.

I. Multi-speed Motors:
   1. Type: Motors may be one of the following:  
      a. Two speed, two winding 1800/900 rpm.  
      b. Two speed, one winding 1800/900 rpm.

J. Belt-driven motors over 5hp shall have dual push-pull adjustment screws.

2.2 STARTERS

A. Manufacturers:
   1. Allen Bradley  
   2. Cutler-Hammer  
   3. General Electric  
   4. Square D

B. General:
   1. Starters shall be standard NEMA sizes and UL listed.
C. Type: Across the line except where noted.

D. Enclosure: NEMA Type as required for location.

E. Overload Protection:
   1. Type: Trip-free thermal overload relay, each phase.
   2. Location: Each ungrounded conductor.
   4. Ambient Temperature Compensation: Provide where required.
   5. Overload protection to be sized for nameplate running amps.

F. Auxiliary Contacts:
   1. Provisions to add three without removing starter from enclosure.
   2. Number: Provide up to three per starter as required for control sequence, and one (1) auxiliary contact.
   3. Switchable type, easily changed from N.O. to N.C. without removing from its mounting.

G. Switches in Cover:
   1. Manually Controlled: Three wire start-stop.
   3. Start and stop indicating lights.
   4. Equipment used for life safety (smoke exhaust, etc.): Hand-Automatic.
   5. Equipment not designed to run continuously: Off-Automatic.

H. Control Transformer:
   1. Provide when line voltage exceeds 208 volts.
   2. Secondary wiring shall have one leg fused and the other grounded.
   3. Secondary voltage not to exceed 120 volts.

I. Provide starters for all motors as follows:
   1. Single phase motors less than ½ hp.
      a. With internal overload protection: None.
      b. Without internal overload protection:
         1) Manually Controlled: Manual starter.
         2) Automatically Controlled: Magnetic starter.
   2. Single phase motors ½ hp and larger:
      b. Automatically Controlled: Magnetic starter.
   3. Three Phase Motors: Magnetic starter.

J. Soft Start Starters:
   1. Provide Y-Delta or solid state reduced voltage starters for all motors 50hp and larger.
   2. Starter shall limit starting voltage to 200% of full load voltage.
K. Multi-Speed Starters:
   1. Starters shall be suitable for the type multi-speed motor selected.
   2. Provide time delay for automatic transfer from high to low speed.

L. Housing coils to be 120V.

M. Motor Protection: (above 20 hp)
   2. Provide under-voltage protection.

PART 3 - EXECUTION

3.1 MOTORS
   A. Install motors on motor mounting systems so coupling or belt drive is properly aligned. Provide proper belt tension. Dowel direct coupled motors.

3.2 STARTERS
   A. Deliver to installer of electrical work.
   B. All safety devices shall be wired so that they will stop the motor with a hand-off-automatic switch in the hand as well as the automatic position.

END OF SECTION 230513
PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Welder Qualifications: Welders, both on-site and off-site, shall be certified for the type of work being performed by the following:

1. Welding shall be performed by ASME Certified Welders with current certificate in accordance with ANSI B31.1 for shop and project site welding of piping work.

B. Welder Certificates:

1. Submit one copy of certificate to Architect/Engineer.
2. Maintain one copy on project site.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Refer to the following sections:

1. 22 10 00 - Plumbing Piping

2.2 GROOVED PIPE COUPLING SYSTEMS

A. Manufacturers of Coupling System:

1. Basis of Design: Victaulic
2. Other Acceptable Manufacturers: Grinnell and Gruvlok. Alternate is to provide a system of standard weight black steel pipe with black steel standard weight butt weld or 125 lb cast iron flanged fittings.
3. All couplings, gaskets and joining method adapters shall be provided by one manufacturer. Fittings may be by another manufacturer provided that the groove dimensions comply with the below referenced standards.

B. Dimensional Standards:

1. All grooved pipe fittings, couplings, and specialties shall conform to standard dimensional standards ANSI/ANWA C-606 or MIL-P-11087C.

C.Acceptable Products:

1. Only the following grooved pipe products may be used:

   a. **Gaskets:** (ASTM D2000) EPDM, for water service, with or without propylene glycol -30°F to 230°F, primary seal by compression of coupling housing, either pressure or vacuum shall assist in sealing force.
   b. **Couplings - Steel Pipe:** Ductile iron (ASTM A-536) or malleable iron (ASTM A-47), with enamel paint coating.

      1) Rigid Couplings: Style 07 zero flex.
      2) Flexible Couplings: Style 77, or Style 75.
c. **Flange Adapters:** Same materials as couplings. Provide for rigid connection to grooved pipe. Provide flange washers and/or flange gaskets as required for mating to non-standard flanges, such as butterfly valves with elastomeric face, or serrated face flanges.

   1) ANSI Class 125 or 150: Style 741.
   2) ANSI Class 300: Style 743.
   3) Alternate to flange adapter: Flange by groove nipple #41 (Class 125), #45 (Class 150), #16 (Class 300).

d. **Branch Outlet Couplings:** Design similar to coupling with integral side outlet.

e. **Fittings for steel pipe:** Standard pattern fittings, ductile iron (ASTM A-536), malleable iron (ASTM A-47) or segmentally welded Schedule 40 steel (ASTM A-53) with enamel paint coating. All changes in direction greater than 22º shall be with R=1.5D radius elbow. All branches and changes in direction in drainage piping shall be made with sanitary type lateral branches and R=1.5D elbows.

f. **Accessories:** Other piping accessories such as strainers, suction diffusers and flow indicators may be provided with grooved ends, all such accessories shall comply with the applicable specification section.

2. All other pipe products shall conform to the requirements of other Divisions 21 through 23 sections. Acceptance of grooved pipe systems does not imply acceptance of the coupling manufactures valves, branch outlets, strainers, or other specialties.

**PART 3 – EXECUTION**

3.1 **PIPE INSTALLATION**

A. **General:**

   1. Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure.
   2. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly, maintenance or replacement of valves and equipment.
   3. Reduce sizes by use of reducing fittings.
   4. Install piping without springing or forcing.
   5. Provide sufficient swing joints, anchors, expansion loops and devices necessary to permit free expansion and contraction without causing undue stresses.
   6. Support piping independently at equipment so its weight will not be supported by the equipment.
   7. Support piping to maintain a consistent slope as indicated on the drawings without sagging or pocketing of any kind. Where not otherwise indicated, all horizontal piping shall slope a minimum of 1/16 inch per foot to drain at system low points.
   8. Provide manual air vents at high points of all pumped piping systems. Provide drains at all low points.
   9. Install horizontal piping parallel to building construction, make any changes in direction with fittings.
B. Location:

1. Locate piping runs, except as otherwise indicated, both vertically and horizontally to allow for complete drainage of piping system (pitched to drain).
   a. Avoid diagonal runs wherever possible.
   b. Orient horizontal runs parallel with walls and column lines.

2. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of the building.
   a. Limit clearance to 0.5" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any.
   b. Where possible, locate insulated piping for 1.0" clearance outside insulation.

3. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction or above suspended ceilings.
   a. Do not encase horizontal runs in solid partitions, except as otherwise indicated.

C. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures.

1. Exception: where shown on drawings or where accepted by the Engineer, provide drip pan under piping, and conform to NEC.

2. In no case shall piping run directly above transformers, electrical panels or switchgear.

D. Dielectric Unions: Install dielectric unions to prevent galvanic action between ferrous and non-ferrous piping.

1. Install in an accessible location or provide access doors.

3.2 WELDING

A. Welding:

3. Use recommended bevels and spacing between ends of pipe to assure full penetration complete to inside diameter of pipe.

B. Welded Joints:

1. Will be observed visually by the Architect/Engineer.
2. Any weld judged defective from a visual observation, shall be ordered tested at the expense of the Contractor or chipped out for full depth and re-welded.

C. Welding Fittings:

1. Unless otherwise noted, make all changes in direction and branch take offs with manufactured fittings.
   a. Use long radius (R=1.50) fittings wherever possible.
2. Shop Fabricated Fittings:
   a. Branches more than two pipe sizes smaller than main line may be made with "weld-o-let" type pre-manufactured saddle fittings.
   b. Where specifically allowed by the Engineer, angles of less than 22½º and branch piping from headers may be made by shop fabricated or manufactured metered fittings.
   c. Submit shop drawings.
   d. Thoroughly clean fittings to remove slag.
   e. Fittings shall be available for observation by the engineer prior to installation.

3. In no case will field made miters or weld-o-let fittings be allowed. Exception: Temperature control wells and water treatment taps may be made with weld-o-let fittings in pipe 3” or larger in diameter.

3.3 COPPER TUBING JOINTS AND FITTINGS
   A. Unless otherwise noted, make all couplings, changes in direction, branch outlets, and transitions to other materials or joining methods with standard manufactured fittings.

   B. Do not expand or swage piping in lieu of proper solder fittings.

   C. Do not extrude or "pull" branch outlets with "tee-drill" type equipment.

   D. Do not use self tapping type branch outlets.

   1. See "hot taps" below.

3.4 THREADED JOINTS AND FITTINGS
   A. All threaded joints shall be made in accordance with American National Standard B2.1.

   1. Do not overthread pipe.
   2. Apply pipe joint compound on male threads only.
   3. Do not use right and left hand threaded joints to make a "union".

   B. Do not thread steel pipe schedule 10 or lighter.

   1. UL listed light wall pipe may be threaded in accordance with its listing.

3.5 MECHANICAL COUPLING SYSTEMS
   A. All changes in direction shall be made with radius type elbows.

   1. Use long radius (R=1.5D) fittings wherever possible.
   2. Angles less than 22½º may be made with pre-manufactured metered fittings.
   3. Use of the angular deflection capabilities of grooved pipe couplings for intentional changes of direction shall not be allowed.
B. All branch outlets shall be made with pre-manufactured 3-way fittings.
   1. Shop fabricated Weld-o-let style welded saddle fittings may be used for branches more than two pipe sizes smaller than the main.
   2. Mechanical saddle tap fittings shall not be allowed.

C. Pipe shall be adequately laterally supported to prevent “pipe squirm”. Provide a minimum of one hanger per pipe section. No pipe section shall be left unsupported between any two couplings.
   1. Rigid type couplings may be considered equivalent to welded or soldered pipe for the above requirements.

D. Risers more than 20' high shall be made with rigid type couplings.

E. Grooved pipe systems shall not be considered to be electrically conductive.
   1. Provide wire jumpers across all couplings where the piping system is required to be electrically conductive.
   2. Cold water piping using grooved pipe systems shall not be used for building ground.
      a. Provide a engraved plastic sign at the building water entrance stating “Mechanical Coupling System”. Not Electrically Conductive”.

F. Flexible couplings may be used for vibration elimination.
   1. Follow manufacturer’s recommendation.
   2. Provide 3 degrees of freedom by installing sufficient flexible couplings in different orientations.
   3. Use spring hangers for all sections of pipe intended for deflection.
   4. Roll grooved fittings and pipe shall be considered to have ½ the deflection of cut grooved fittings and pipe.

3.6 HOT TAPS

A. Installing a branch line in piping while under service or static pressure (hot taps) shall only be done where specifically authorized

B. Submit the proposed method of procedure for each fluid service and pipe material.
   1. Hot tap procedure shall remove a plug of main tap material and retrieve it. The plug shall be a maximum of 1 pipe size smaller than the branch size. Hang the removed plug by a chain at the completed tap.
   2. Hot tap procedure shall not affect the temperature or pressure rating of the piping system.
   3. Hot tap procedure shall be done through a gate or ball valve.

3.7 SENSOR WELL TAPS

A. Sensor wells shall be placed in taps made in accordance with the above requirements for branch outlets.
3.8 CLEANING, FLUSHING, INSPECTING

A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings, if any.

B. Flush out water and piping systems with clean water before proceeding with required tests.

C. See specific pipe service section for further requirements.

3.9 PIPING TESTS

A. Provide temporary equipment for testing, including pump, thermometer and gauges.

B. Test piping system before insulation is installed wherever feasible, and remove control devices before testing.

C. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating.

D. Fill each section of water, drain or vent piping with water and pressurize for two hours at 150% of operating pressure, but not less than 25 psig for pressure piping, and ten feet of head for drain and vent piping.

E. Test fails if leakage is observed, or if temperature compensated pressure drop exceeds 1% of test pressure.

F. Disassemble and re-install sections which fail the test by using new materials to the extent required to overcome leakage.

1. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

G. After testing and repair work have been completed, drain test water from piping systems.

3.10 PAINTING

A. Exposed piping shall be painted. Pipe shall be cleaned by this contractor and ready for priming and painting.

END OF SECTION 230521
PART 1 - GENERAL

1.1 SUBMITTALS

A. Manufacturer’s Data - Piping Accessories: Submit manufacturer’s data on the following piping accessories:

1. Sealing compound for sleeves.
2. Expansion compensators.
3. Flexible pipe connections.
4. Guides.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

A. Escutcheon Plates:

1. Type: Split ring
2. Construction: Brass
3. Finish:
   a. At Painted Surfaces: Prime coat
   b. At Other Surfaces: Nickel or Chrome plate
4. For Floor Sleeves: Where sleeves extend above floor surface, provide depth to cover sleeve.

B. Expansion Compensators, Two Inch and Smaller:

1. Manufacturers - Design Basis: Flexonics
2. Other Acceptable Manufacturers:
   a. Adsco
   b. Keflex
   c. Metraflex
   d. Advanced Thermal Systems
3. Stroke: $\frac{1}{4}”$ extension, $1\frac{3}{4}”$ compression.

C. Expansion Compensators, Two and a Half Inch and Larger:

1. Manufacturers - Design Basis: Advanced Thermal Systems
2. Other Acceptable Manufacturers:
   a. Adsco
   b. Keflex
   c. Metraflex
   d. Flexonics
3. Model: TP2
4. Stroke: 1" extension, 4" compression (each slip joint). Double expansion joint shall be able to provide 4" for each direction.
5. Comply with requirements of ASME Boiler and Pressure Vessel Code and ASTM F1007.
6. Provide models and components suitable for application (i.e. steam).
7. High pressure steam shall be provided with joints designed for 300 lb. service at 500F.
8. Expansion joint shall be slip design and furnished with a anchor base. Packing shall be able to be inserted under full line pressure.
9. Packing friction force for the expansion joint shall not exceed 1000 lbs. per inch of expansion joint nominal diameter.

D. Flexible Pipe Connectors:
1. Manufacturers - Design Basis: Mason
2. Other Acceptable Manufacturers:
   a. Metraflex
   b. Flexonics

E. Pipe Alignment Guides:
1. Manufacturers - Design Basis: Flexonics
2. Other Acceptable Manufacturers:
   a. Adsco
   b. Keflex
   c. Advanced Thermal Systems
3. Model: PG
4. Material:
   a. Spider: Steel for steel pipe, bronze for copper tubing.
   b. Ring: Steel
   c. Travel: 3"

2.2 FABRICATED ACCESSORIES

A. Steel-Pipe Sleeves: Fabricate from Schedule 40 steel pipe. Remove burrs.

B. Iron-Pipe Sleeves: Fabricate from service weight cast-iron pipe. Remove burrs.

C. Sheet-Metal Pipe Sleeves: Fabricate from galvanized sheet-metal, closed with lock-seam joints.
   1. For following pipe sizes, provide gauge indicated:
      a. Three Inch Pipe and Smaller: 20 gauge
      b. Four Inch to Six Inch Pipe: 16 gauge
      c. Over Six Inch Pipe: 14 gauge
PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipe Sleeves:
   1. Install pipe sleeves where piping passes through walls, floors, ceilings, roofs and structural members, except soil pipe penetrations through concrete slab on grade.
   2. Where possible pour sleeve in place or grout.
   3. Provide sleeves of adequate size, accurately centered on pipe runs, so that piping and insulation (if any) will have free movement in the sleeve in non-fire rated penetrations.
   4. In fire rated penetrations, size sleeves such that the resulting annular space is in accordance with the application requirements of the fire stopping system. Refer to Section 230503. All above grade floor penetrations shall be considered to be fire-rated.
   5. Install length of sleeve equal to thickness of construction penetrated, plus extend floor sleeves 0.25" above floor finish. Where floor surface drains to a floor drain, extend floor sleeve 2" above floor finish. Extend 4" above floor in kitchens and mechanical rooms, bathrooms, janitor closets and other wet areas.
   6. Provide temporary support of sleeves during placement of concrete and other work around sleeves.
   7. Provide temporary closure to prevent concrete and other materials from entering pipe sleeves.
   8. Except as otherwise indicated, install steel pipe sleeves.
   9. At interior partitions and ceiling, install sheet metal sleeves.
   10. At exterior penetrations below grade, install iron pipe sleeves.
   11. Seal exterior sleeve penetrations at grade weather tight.

B. Caulking:
   1. Where water seal or sound seal, but not fire seal, is needed, (foundation walls, slab on grade): fiberglass backing and heavy bead of silicone caulking compound.
   2. Where sleeve pierces a fire separation: Fire stop material in accordance with manufacturer's directions and UL listing. Refer to Section 230503.

C. Install escutcheon plates at pipe sleeves where piping is exposed to view in occupied spaces of the building, on the exterior, and elsewhere as indicated.

D. Compensators: Install where shown or where required because piping arrangement does not provide sufficient flexibility.
   1. Protect compensators from over-travel and over-stress during remaining installation and testing.

E. Flexible Connectors: Install at right angles to displacement.
   1. Install one end immediately adjacent to isolated equipment and anchor other end.

F. Guides: Install where shown and where required in accordance with expansion compensators published requirements.
   1. As a minimum, install one guide within four pipe diameters of compensator, and one guide 14 pipe diameters from first guide.
END OF SECTION 230522
PART 1 - GENERAL

1.1 SUBMITTALS

A. Manufacturer’s Data: Submit manufacturer’s product data including:
   1. Dimensions
   2. Sizes
   3. End Connections
   4. Weights
   5. Installation instructions
   6. Instructions on repacking and repairing valves.
   7. Range of flow for balancing valves and plug valves.

B. Valve Tag List: Refer to Section 230553 of the Specifications.

PART 2 - PRODUCTS

2.1 VALVES TYPES AND SIZES

A. Where type or body material is not indicated, provide valve with pressure class selected from MSS or ANSI standards, based on the maximum pressure and temperature in the piping system.

B. Except for balancing or otherwise indicated, provide valve of same size as connecting pipe size.

C. Unless specifically required by note or symbol, all water valves shall be full port ball valves. If ball, butterfly, globe, plug, or balancing valves are called out by note or symbol, only that type of valve is acceptable.

D. Gate valve are acceptable for use in steam system only.

E. Where pipe sizes overlap, contractor has the option of threaded or flanged valves.

F. Where grooved pipe mechanical coupling systems are accepted, provide flange adapters to mate with valves as specified below. Valves by the mechanical coupling system manufacturer shall not be used unless they meet all of the specified requirements for a given valve.

G. All valves shall be domestically manufactured.

H. Valves used for domestic water service shall be bronze or other material suitable for domestic water. Iron body valves are not acceptable.

2.2 BALL VALVES

A. Manufacturers:
   1. Design Basis: Apollo
2. Other Acceptable Manufacturers:
   a. Milwaukee
   b. Hammond
   c. Dynaquip
   d. Jenkins
   e. Jomar

B. Bronze, 150, SWP, 600 WOG (min), chrome plated solid, stainless steel ball and stem, two piece design, blow-out proof stem, adjustable packing gland nut (allowing handle to be removed without leaking) TFE seats, MSS-SP-77.
   1. Model: 77 Series - Full port.

C. Options: Provide the following where required:
   1. Extended stems for insulated valves.
   2. Memory stop device for balancing applications.
   3. Tee handle for tighter areas.
   4. Hose end and cap for drain.
   5. Mounting pads for actuator.
   6. Bleed port for compressed air.

2.3 BALANCING VALVES

A. Manufacturer:
   1. Gerand
   2. Flow design “flow set”
   3. Presso

B. 175 psi at 250ºF.

C. Connections: Threaded or flanged.

D. Pressure Reading Ports:

E. “P/T” Ports, Shraeder valves, or Hansen type quick connect. No “refrigeration” fittings.

F. Design, variable orifice type:
   2. Multiple turns of handwheel from full closed to full open.
   4. Memory stop device to allow valve to be returned to balanced position after being closed.

G. Design, valve and venturi type:
   1. Ball valve complying with the above requirements for ball valves.
   2. Fixed orifice or venturi, upstream of valve.
   3. Taps on venturi, upstream and downstream.
   4. Memory stop device to allow valve to be returned to balanced position after being closed.
   5. Regardless of the manufacturer’s claims, these valves shall not be considered as tight shut off for service. Provide additional valves for equipment isolation.
H. Insulation: Provide premolded insulation conforming to the valve body. Material shall have a flame spread of 25 and a smoke developed of 50.

2.4 DRAIN VALVES

A. Ball valve with hose end cap.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the following requirements:

1. Install valves with stems pointing up, and as close to vertical as possible.
2. Install valves at each piece of equipment, fixture or appliance so that the supply and return services can be shut off to remove the item without draining the remainder of the piping system.
3. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping.
4. Locate valves so as to be accessible.
5. Combination balancing and shut-off valves may be used instead of a separate balancing valve and shut-off valve if the valve has a memory stop and the manufacturer lists its use as a leak-proof service valve.
6. Provide drain valves at main shut-off valves, low points of piping and apparatus.
7. Provide separate support where necessary.
8. Do not allow meter connections of balancing valves to point downward.
9. Install valves so bypass valves are accessible.

B. All valves of a given type shall be of one manufacturer.

C. Provide extended stems on insulated system to prevent interference of operator with insulation.

3.2 VALVES USED FOR THROTTLING/BALANCING

A. Balancing valves shall not be used for flow indication in pipes 2½” and larger, or in pump discharge piping.

B. Flow indication in piping 2½” and larger and in pump discharge piping, shall be by a venturi with a plug, butterfly, or globe valve for throttling.

C. Throttling/Balancing Valves shall be selected so that the maximum design flow causes between 1’ and 10’ W.G. pressure drop or meter reading with the valve wide open.

D. Install balancing valves used for flow indication with a minimum of five times the pipe diameter downstream and two times the pipe diameter upstream of a fitting or valve.

E. Globe, ball, butterfly, or plug valves may be used for throttling/balancing. Provide an infinitely variable, lockable memory stop device to allow the valve to be returned to the “balanced” position after closing, and to prevent movement of the disk or plug during operation. When ball valves are used for throttling, provide and additional valve for equipment isolation.
PART 1 - GENERAL

1.1 STANDARDS

A. Comply with MSS Standard Practice SP-69, published by Manufacturer’s Standardization Society of the Valve and Fitting Industry for type and size.

1.2 SUBMITTALS

A. Submit manufacturer’s product data on the following:
   1. Hangers other than clevis type.
   2. Anchors.

B. Submit structural calculations on trapeze type supports.

PART 2 – PRODUCTS

2.1 PIPE HANGERS

A. General:
   1. Use adjustable pipe hangers on suspended pipe. Trapeze hangers may be used at the Contractor’s option. Contractor shall be responsible for sizing supports.
   2. Chain, wire or perforated strap hangers will not be permitted.
   3. Isolate hangers in contact with dissimilar materials with dielectric hanger liners. Tape is not acceptable.
   4. Provide supports between piping and building structure where necessary to prevent swaying.

B. Hanger and Rod Material:
   1. Exposed in public areas: Zinc electroplated steel.
   2. Concealed or in service areas: Black threaded steel.
   3. Outside, exposed to weather: Hot dipped galvanized.
   4. Buried below structural slab: Stainless Steel

C. Spot Concrete Inserts: Steel case and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms.
   1. Size inserts to match size of threaded hanger rods.
   2. Inserts to be UL and FM listed.

D. Channel Type Inserts:
   1. Standard channel support with anchor tabs on 4" centers, and nail holes for attaching to forms.
   2. Styrofoam inserts to prevent wet concrete seepage.
E. Expansion Anchors:

1. For use only where modifications to piping layouts to change from pre-installed insert locations.
2. Inserts shall be of the drill, insert, expand type. Power driven fasteners are not acceptable for piping.
3. Contractor shall select the appropriate type based on the following:

<table>
<thead>
<tr>
<th>Rod Size</th>
<th>Maximum Working Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>600 pounds</td>
</tr>
<tr>
<td>½</td>
<td>1100 pounds</td>
</tr>
<tr>
<td>5/8</td>
<td>1800 pounds</td>
</tr>
<tr>
<td>¾</td>
<td>2700 pounds</td>
</tr>
<tr>
<td>7/8</td>
<td>3700 pounds</td>
</tr>
</tbody>
</table>

F. Steel Structure Attachments:

1. Contractor may select welded or mechanically attached. All mechanically attached supports shall have jam nuts or other means to prevent loosening. Maximum loading requirements are as follows:

<table>
<thead>
<tr>
<th>Rod Size</th>
<th>Maximum Working Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>600 pounds</td>
</tr>
<tr>
<td>½</td>
<td>1100 pounds</td>
</tr>
<tr>
<td>5/8</td>
<td>1800 pounds</td>
</tr>
<tr>
<td>¾</td>
<td>2700 pounds</td>
</tr>
<tr>
<td>7/8</td>
<td>3700 pounds</td>
</tr>
</tbody>
</table>

G. Single Hangers:

1. Piping 2” and smaller: MSS type 1, Clevis hanger or type 7 adjustable swivel ring hanger. Minimum 180 pounds design load.
2. Piping 2½” and larger: MSS type 1 Clevis hanger.
3. Bare copper pipe: Above hangers, plastic or Neoprene coating, sized for copper pipe O.D. and copper coated for identification.

H. Trapeze hangers and wall supports:

1. Channel strut or structural steel shapes. Contractor shall follow channel strut manufacturers guidelines for loading or provide structural steel supports designed by a professional Engineer, licensed in the same state as where the project is located.
2. All piping shall be attached to the support by means of a channel strut clamp, U-bolt, or pipe rollers which will maintain lateral position of the pipe but allow longitudinal movement. Provide dielectric isolation between all dissimilar metals.
3. All insulation shall be continuous at supports. Do not notch or penetrate insulation.

I. Vertical Supports: Steel riser clamp at each floor penetration or every 6 foot supported from wall bracket, and within 6” of control valves (both sides). Do not anchor riser clamps.

J. Hangers:

2. Multiple or Trapeze: Steel channels with welded spacers and hanger rods.
3. Hanger Sizes and Spacing:
   a. For gas, domestic water and drain piping, conform to the 1 BC/IMC/IPC for spacing, and the following table for hanger rod sizes.
   b. For steam and hydronic piping, conform to the following table:

<table>
<thead>
<tr>
<th>PIPE TYPE</th>
<th>PIPE SIZE</th>
<th>MAXIMUM SPACING</th>
<th>MINIMUM HANGER ROD SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Pipe</td>
<td>½”</td>
<td>6'-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td></td>
<td>¾” thru 1¼”</td>
<td>8'-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td></td>
<td>1½” and 2”</td>
<td>10'-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td></td>
<td>2½” thru 3½”</td>
<td>12'-0”</td>
<td>½”</td>
</tr>
<tr>
<td></td>
<td>4” and 5”</td>
<td>15'-0”</td>
<td>5/8”</td>
</tr>
<tr>
<td></td>
<td>6”</td>
<td>17'-0”</td>
<td>¾”</td>
</tr>
<tr>
<td></td>
<td>8” thru 12”</td>
<td>12'-0”</td>
<td>7/8”</td>
</tr>
<tr>
<td>Copper Pipe</td>
<td>½” thru 1”</td>
<td>6'-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td></td>
<td>1¼” thru 2”</td>
<td>10'-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td></td>
<td>2½” thru 3”</td>
<td>10'-0”</td>
<td>½”</td>
</tr>
<tr>
<td>Cast Iron Soil</td>
<td>2”</td>
<td></td>
<td>3/8”</td>
</tr>
<tr>
<td></td>
<td>3” to 5”</td>
<td></td>
<td>½”</td>
</tr>
<tr>
<td></td>
<td>6”</td>
<td></td>
<td>5/8”</td>
</tr>
<tr>
<td></td>
<td>8” to 12”</td>
<td></td>
<td>¾”</td>
</tr>
</tbody>
</table>

K. Insulated Pipe Supports:
1. Size pipe supports for outside diameter of pipe insulation.

L. Wall Supports:
1. ½” through 3”: Unistrut type channel and steel clamp.
   a. Use Hydrosorb cushions on copper pipe.
2. 4” and Over: Welded steel bracket and wrought steel clamp.

M. Pipes over five inches 120º: Provide cast iron roller supports.

2.2 INSULATION INSERTS
A. Pipe shall be protected at the point of support by a 360º insert of high density, 100 psi, waterproofed calcium silicate, encased in a sheet metal shield. Insert to be same thickness as adjoining pipe insulation. Insulation insert to extend one inch beyond sheet metal shield on all “cold” lines. If pipe hanger spacing exceeds ten feet and for all pipe roller applications, utilize double layer shield on bearing surface.

B. Provide 180º insulation inserts when utilizing clevis hangers. Provide 360º insulation inserts at all trapeze and wall supports.
2.3 PIPE ANCHORS

A. Manufacturers:
   1. Design Basis: Flexonics
   2. Other Acceptable Manufacturers:
      a. Adsco
      b. Keflex
      c. Hilti

B. Model AC with threaded ends and welded angle brackets for steel pipe.

C. Model AC copper tube with solder ends and steel angle brackets brazed to tubing for copper tube.

D. Anchors may be field fabricated similar to manufactured products specified.

2.4 PIPE GUIDES

A. Manufacturers:
   2. Other Acceptable Manufacturers:
      a. Fee & Mason
      b. Grinnel
      c. M-Co
      d. PHD

B. Any of the Following:
   1. Spider Type: B3281-7.
   2. Roller Type: 2 sets of rollers on opposite sides of pipe.
   3. Slide Type: B3893 with hold down lugs.
      a. Not for use with cold piping.
   4. Light duty, 1½” and smaller copper: U bolt or channel strut clamp (B2417) allowing clearance from O.D. of pipe or insulation.

PART 3 – EXECUTION

3.1 INSTALLATION OF PIPE SUPPORTS

A. Adequately support piping from the building structure with adjustable hangers to maintain uniform grading where required and to prevent sagging and pocketing.
   1. Provide supports between piping and building structure where necessary to prevent swaying.
   2. Do not support pipe from other pipe or equipment.
3. Provide thrust restraints at all changes in direction on 8” and larger cast iron piping with no hub or hub and spigot fittings.

B. Install hangers to provide minimum ½” clear space between finished covering and adjacent work.
   1. Place a hanger within one foot of each horizontal elbow.
   2. Space hangers generally as called for in Table in Part 2, Products.

C. Use hangers, which are vertically adjustable 1-½” minimum after piping is erected.

D. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
   1. Set inserts in position in advance of concrete work.
   2. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
   3. Do not penetrate concrete “TT” legs for piping inserts. Do not penetrate the stressed (i.e. lower) chords of any structural member.

E. Provisions for Movement: Install hangers and supports:
   1. To allow controlled movement of piping systems.
   2. To permit proper movement between pipe anchors.
   3. To facilitate the action of expansion joints, expansion loops, bends and offsets.
   4. To isolate force due to weight or expansion from equipment connections.

F. In general, attach hangers to upper chord of roof trusses and floor joists, using long rods to facilitate pipe movement.

G. Anchors:
   1. Securely anchor piping where indicated or where required for a proper installation and to force the pipe expansion in the proper direction.
   2. Anchors shall be suitable for the location of installation and shall be designed to withstand not less than five times the anchor load.
   3. Anchor vertical pipes by means of clamps welded around pipes and secured to wall or floor construction. Anchor at bottom of riser only but provide guides for vertical thermal movement.

END OF SECTION 230529
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of Contract, including General and Supplemental Conditions of the Construction Contract and Division 1 Specification Sections (General Requirements), apply to this Section.

1.2 DESCRIPTION
A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.3 MATERIAL AND EQUIPMENT
A. Design Basis: Mason Industries
B. Alternate Manufacturers:
   1. Amber/Booth Co.
   2. Korfund Dynamics Corp.
   3. Vibration Mountings & Controls, Inc.
C. Unless otherwise specified, supply only new equipment, parts and materials.

1.4 QUALITY ASSURANCE
A. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.
B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.
C. Supply and install any incidental materials needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, without claim or additional payment.
D. Verify correctness of equipment model numbers and conformance of each component with manufacturer’s specifications.
E. Should any rotating equipment cause excessive noise or vibration, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer’s specifications for the unit in question.

1.5 SUBMITTALS
A. Reference Division 1.
B. Prior to ordering any products, submit shop drawings or the items listed below. The shop drawings must be complete when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.

1. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.
2. Detailed selection data for each vibration isolator supporting equipment, including:
   a. The equipment identification mark;
   b. A cut sheet of the isolated equipment showing equipment support points and operating weight at each point.
   c. The isolator type;
   d. The actual load;
   e. The static deflection expected under the actual load;
   f. Specified minimum static deflection;
   g. The additional deflection-to-solid under load;
   h. The ratio of spring height under load to spring diameter.
3. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
4. Special details necessary to convey complete understanding of the work to be performed.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION MOUNT TYPES

A. General:

1. All metal parts of vibration isolation units installed out-of-doors shall be cold-dip galvanized, cadmium plated, or neoprene coated after fabrication. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, laborsaving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories must not degrade the vibration isolation system.
4. Static deflection of isolators shall be as provided in SECTION 3 - EXECUTION. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type HSN (Hanger Spring and Neoprene)

1. Vibration isolation hangers shall consist of a free standing and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30º arc before contacting the housing. Hangers shall provide a means to adjust hanger elevation under load. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a
minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3” minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.

Type HSN isolators shall be Mason Type P30N or approved equal.

C. Type HN (Hanger Neoprene)

1. Vibration isolation hangers shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck bushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30º arc before contacting the hanger housing.

Type HN isolators shall be Mason Type HD or approved equal.

2.2 RESILIENT LATERAL GUIDES

A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN which are specifically designed to provide resilient lateral bracing of duct or pipe risers.

Resilient lateral guides shall be Mason Type ADA.

2.3 FLEXIBLE DUCT CONNECTORS

A. Flexible duct connection shall be made from coated fabric (or leaded vinyl if called for on the drawings). The clear space between connected parts shall be a minimum of 3” and the connection shall have 5” minimum of slack material.

2.4 FLEXIBLE PIPE CONNECTIONS

A. Flexible pipe connection shall be fabricated of multiple plies of nylon cord, fabric, and neoprene; and shall be vulcanized so as to become inseparable and homogeneous. Flexible connections shall be formed in a double sphere shape, and shall be able to accept compressive, elongative, transverse, and angular movements.

B. The flexible connections shall be selected and specially fitted, if necessary, to suite the system temperature, pressure, and fluid type. In addition, suitable flexible connections should be selected which do not require rods or cables to control extension of the connector.

C. Connectors for pipe sizes 2” or smaller shall have threaded female union couplings on each end. Larger sizes shall be fitted with metallic flange couplings.

D. Flexible pipe connections shall be mason Industries Type BSS braided stainless steel hose with carbon steel fittings.
2.5 RESTRAINTS

A. Snubber:
   1. Snubbers shall be custom fabricated using Type FN isolators mounted to steel angle brackets. The steel angle shall be sufficiently rigid and the mounting sufficiently secure to resist excessive movement of equipment during on-off cycle.

2.6 GROMMETS

A. Grommets shall either be custom made by combining a neoprene washer and sleeve, be Isogrommets as manufactured by MBIS, Inc. (Bedford Heights, Ohio), or be Series W by Barry Controls (Watertown, Mass.). Grommets shall be sized so that they will be loaded within the manufacturer’s recommended load range. Grommets shall be specially formed to prevent both from directly contacting the isolator base plate.

2.7 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

<table>
<thead>
<tr>
<th>Acoustical Sealant</th>
<th>D.A.P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR-96</td>
<td>Pecora</td>
</tr>
<tr>
<td>Acoustical Sealant</td>
<td>Tremco</td>
</tr>
<tr>
<td>Acoustical Sealant</td>
<td>U.S.G.</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.1 APPLICATION

A. General:
   1. Refer to SECTION 2 - PRODUCTS of this specification for vibration isolation devices identified on the drawings or specified herein.
   2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment:
   1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on 4” high concrete housekeeping pads. See architectural or structural drawings for details.
   2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as scheduled on the drawings or specified hereunder.
   3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the drawings.
   4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment in the positions shown on the drawings.
   5. Thrust restraints shall be installed on all floor-mounted fans developing 4” or more of static pressure, all suspended fans developing 2” or more static pressure, and wherever else called for on the drawings.
6. Snubbers shall be installed as called for on the drawings.

C. Miscellaneous Mechanical Equipment:

1. Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks, and expansion tanks which are connected to isolated piping system shall be vibration isolated from the building structure by Type NP or Type HN isolators (selected for 0.1” static deflection) unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

D. Pipes:

1. All chilled water, condenser water, heating water, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:
   a. Within mechanical rooms.
   b. And within 50’ total pipe length of connected vibration-isolation equipment (chillers, pumps, air handling units, pressure reducing stations, etc.).

2. Piping shall be isolated from the building structure by means of vibration isolation mounts, resilient pipe guides, and resilient penetration sleeve/seals.

3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than ½” Type FSN or HSN isolators shall be used. Minimum 1.5” deflection.

4. Where lateral support of pipe risers is required within the specified limits, this shall be accomplished by use of resilient lateral supports.

5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

6. Provide flexible pipe connections on all piping connected to all isolated equipment and wherever shown on the drawings.

7. All sprigs to be pre-compressed type.

3.2 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General:

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.

2. Installation of vibration isolation equipment shall be in accordance with the manufacturer’s instructions.

B. Isolation Mounts:

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases, which are parallel to equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be
provided to maintain stability of supported equipment, whether or not such a base is specifically called to herein.

4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.

5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beam joists. Provide suitable intermediate support members as necessary.

6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.

7. Parallel running pipes may be hung together on a trapeze, which is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and non-isolated pipes on the same trapeze.

8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.

9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.

10. The installed and operating heights of equipment vibration-isolated with Type FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide ¼” clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases:

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer’s requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

2. Unless otherwise indicated, there is to be a minimum operating clearance of 1” between inertia bases or steel frame bases and the floor beneath the equipment. Position isolator mounting brackets and adjust isolators so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Flexible Duct Connections:

1. Sheet metal ducts and plenum opening shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections:

1. Install flexible pipe connections in strict accordance with the manufacturer’s instructions.

F. Restraints:

1. Snubbers shall be adjusted to clear the equipment base and to provide lateral restraint during on-off cycling, but be out of contact during normal operation of the equipment.
2. Thrust restraints shall be attached at the centerline of thrust and symmetrically on each side of the unit. The two rods of the thrust restraint shall be axially aligned. This may require modified brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Resilient Penetration Sleeve/Seals:

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.
   
   a. At minimum, provide resilient penetration seals at all Mechanical, Equipment and Fan Room Penetrations.

3.3 ISOLATOR SCHEDULE

<table>
<thead>
<tr>
<th>UNIT</th>
<th>ISOLATOR TYPE</th>
<th>MINIMUM STATIC DEFL.(IN.)</th>
<th>BASE TYPE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inline Fans</td>
<td>HSN</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fan Coil Units</td>
<td>(Note 2)</td>
<td>(Note 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

1. External isolator may be omitted if units have internally isolated fans and no other rotating or reciprocating components.
2. Isolators for fan coil units should be either HSN with 0.75" minimum static deflection or be equivalent to Mason Industries Type HN with 0.35" minimum static deflection.
3. For slab-on-grade installations isolators are not required. Refer to Section 23 21 23.
PART 1 – GENERAL

1.1 SUBMITTALS

A. Submit manufacturer’s product data on the following:
   1. Plastic Pipe Markers and method of application.
   2. Engraved Plastic Laminate Sign.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated, provide manufacturer’s standard products.

B. Where more than a single type is specified for an application, selection is Installer’s option, but provide a single selection for each application.

2.2 PLASTIC PIPE MARKERS (TYPE A)

A. Provide manufacturer’s standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1 and ANSI Z53.1. Provide Seton Setmark or pre-approved equivalent.

B. For Pipes Less Than Six Inches (including insulation if any): Provide full-band pipe markers, extending 360º around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.
   3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than ¾” wide; full circle at both ends of pipe marker, tape lapped 1-½”.
   4. Provide Setmark Type SNA.

C. For Pipes Six Inches and Larger (including insulation if any): Provide either full-band or strip-type markers, but not narrower than 3 x letter height, taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-½” wide; full circle at both ends of pipe marker, tape lapped 3”. Provide Setmark Type STR.

D. Lettering: Manufacturer’s pre-printed wording which conforms to contract document system descriptions.

E. Match UCB terminology for systems which are modified by this work.

F. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering or as a separate unit of plastic (to accommodate both directions).
2.3 STENCILING (TYPE B)

A. Using a color contrasting to the surface to identify, spray or brush paint through neatly cut stencils.

B. Lettering shall conform to wording on contract documents. Size shall be in accordance with ANSI A13.1.

C. For pipe or insulation up to 1-1/4", provide 8" color field and ½" letters. For pipe or insulation up to 2", provide 8" color field and ¾" letters. For pipe or insulation up to 6", provide 12" color field and 1-1/4" letters. For pipe or insulation over 10", provide 32" color field and 3-1/2" letters. All ductwork and equipment shall have 2-1/2" letters.

2.4 BACKGROUND COLOR AND STENCILING (TYPE C)

A. In addition to the requirements above, paint a background color band in accordance with ANSI A13.1.

2.5 VALVES TAGS

A. Brass Valve Tags: Provide manufacturer’s standard 19 ga brass tag; approximately 1-½" round with ½" high black filled numbers and 3/16" top hole.

   1. Numbers shall be sequential in accordance with schedule below.
   2. Provide separate numbering for each legend sequence. Provide separate sequences for the following:

      a. Gas (GAS)
      b. Domestic Hot Water (DHW)
      c. Domestic Hot Water Recirculation (DHWR)
      d. Domestic Cold Water (DCW)
      e. Heating Water (HTG)
      f. Chilled Water (CHW)
      g. Refrigerant Piping (REF)
      h. All other systems (Legend as required)

B. Valve Tag Fasteners: Manufacturer’s standard chain (wire link or beaded type), or S-hooks.

2.6 VALVE SCHEDULE

A. Provide schedule for each piping system, as defined on the drawings, and below, typewritten and reproduced on 8-½" x 11" bond paper.

B. Tabulate valve number, piping system, system legend (as shown on tag), location of valve (room or space), and variations for identification (if any).

C. Provide piping schematic for each system as defined below in Part 3.

D. In addition to mounted copies, furnish extra copies for maintenance manuals as specified.
E. Valve Schedule Frames: For each page of the valve schedule, provide a glazed frame, with screws for removable mounting on masonry walls.

2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, 1/16” thick, black with white core (letter color).

B. Fastening:
   1. Screws
   2. Rivets
   3. Permanent Adhesive

C. Lettering and Graphics:
   1. Coordinate names, abbreviations and other designations used in the mechanical identification work, with the corresponding designations shown, specified or scheduled in the construction documents.
   2. In addition, for heating or cooling units and exhaust fans, identify area served.

PART 3 - EXECUTION

3.1 GENERAL

A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting.

B. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black or white, whichever provides most contrast with ductwork color.

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50’ spacing along exposed runs.

C. Access Doors: Provide stenciled or plastic laminate type signs on each duct or equipment mounted access door in ductwork and housings, indicating the purpose of the access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
3.3 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers on piping of the following systems and include arrows to show normal direction of flow.

1. Domestic water piping (hot, cold, tempered; 120º hot, hot water recirculating, etc.).
2. Plumbing vent and sanitary (above grade) piping.
3. Storm piping.
4. Heating water piping (supply and return).
5. Chilled water piping (supply and return).
6. Natural gas piping, (indicate pressures).
7. Condenser water (supply and return).
8. Refrigerant piping (suction, liquid, hot gas bypass).
9. Beverage CO₂ piping
10. Steam piping (indicate pressure).
11. Condensate piping.
12. Compressed air piping (indicate pressure).
13. Fire protection. See Section 21 10 00 for required nomenclature and spacing of labels.
14. Any other piping system as indicated on the drawings, or as required to match existing.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces above accessible ceilings, in accessible maintenance spaces, including chases, and above ceiling:

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where there could be a question of flow pattern.
3. Near locations where pipes pass through walls, floors, or ceilings, or enter non-accessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced intermediately at maximum spacing of 50’ along each piping run.
6. Within 6’ of access doors above otherwise non-accessible ceilings and chases.

C. Type:

1. Normally exposed to view - Type A or C.
2. Normally concealed from view - Type B.

3.4 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory fabricated equipment units, plumbing fixtures faucets, hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount framed valve schedules with piping schematics where directed by Owner.

C. Identify each valve tagged on as-built drawings.

D. Valve tags are required only in kitchen and dining spaces. Other areas shall not have valve tags.
3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install an engraved plastic laminate sign on or near each major item of mechanical equipment.

1. Provide signs for the following general categories of equipment and operational devices:
   a. Evaporative Coolers
   b. Fans
   c. Air Handling Units
   d. Condensing Units
   e. Motor Starters and Variable Frequency Drives
       1) Mount near starter, not on cover
   f. Pumps
   g. Chillers
   h. Cooling Towers
   i. Heat Exchangers

B. Provide engraved plastic laminate nameplate on every new piece of equipment not already provided with one in accordance with Section 23 05 02 of the specifications.

C. Identify area served, if applicable.

3.6 CEILING IDENTIFICATION

A. Provide engraved plastic laminate signs at ceilings access doors to identify piping, equipment, valves, fire dampers, smoke dampers, and fire/smoke dampers.

3.7 NON-POTABLE WATER IDENTIFICATION

A. Provide an engraved plastic laminate sign.

   1. Legend: “Non-Potable Water”.
   2. Location: At each outlet of piping downstream of backflow preventer, (e.g. Boiler Room hose bibb).

END OF SECTION 230553
PART 1 - GENERAL

1.1 RESPONSIBILITY

A. The Balancing Contractor shall be a sub-contractor, directly working for the General Contractor.

B. The Balancing Contractor shall not be a sub-contractor of any other Division 21, 22 or 23 Contractor.

1.2 QUALITY ASSURANCE

A. Qualification:

1. Work shall be done by a firm certified by the National Environmental Balancing Bureau (NEBB), or the Associated Air Balance Council (AABC), or the firm shall have technicians certified by the “National Training Fund Sheet Metal & Air Conditioning Industry”.

2. The firm shall be an independent testing and balancing form specializing in testing and balancing of environmental systems.

3. The firm shall have an experience record of not less than five (5) years experience in the TAB industry.

B. Industry Standards: Comply with the following:


C. Registration: Work shall be done under the supervision of a professional engineer registered in Colorado. Engineer shall be available for all meetings and interpretation of all materials in the report.

D. Pre-qualification of TAB Contractor.

1. The firm must have experience and qualifications satisfactory to the consulting mechanical engineer, UCB and must be accepted by him prior to bidding.

2. Firms desiring approval to provide work under this section shall submit a booklet indicating procedures and data forms that they would use in the performance of the work.

3. Submittals shall be in accordance with Section 200101.

4. Only firms which have been approved by the mechanical engineer prior to bid date may provide work under this section.

5. Pre-qualified TAB Contractors will be selected from:

   a. Checkpoint
   b. Finn & Associates
   c. TAB Services
   d. JPG Engineering
PART 2 - PRODUCTS

2.1 PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Sequence work to commence after completion of system and start-up procedures and schedule completion of work before Substantial Completion of Project.

B. Examine the installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable.

C. Notify the Contractor in writing of conditions detrimental to the proper completion of the test-adjust-balance work.
   1. Do not proceed with the work until unsatisfactory conditions have been corrected.
   2. Provide Engineer/Architect with a copy of the notification.

D. Adjust flows to within 10% of values shown. If design flows cannot be obtained within specified limits the Balancing Contractor will perform the following (at the minimum):
   1. Measure and record major pressure drops in the system.
   2. Consult with the Engineer and Installer as required.
   3. Upon receiving written directions to proceed and after any corrections are performed, re-balance affected portion of system.

E. Optimization: Work closely with the Section 23 09 00 contractor to optimize setpoints.
   1. Establish the minimum air static pressure or water differential pressure for variable or bypass flow system.
   2. Establish the position of minimum outside air dampers, damper/valve and sequencing relays.

F. Calibration: Be responsible for calibration of flow measurement devices used as input to the temperature control system. All air systems flow measurement stations including VAV terminals shall be calibrated against a pitot tube traverse or air diffuser capture hood. Balancing contractor shall assure accuracy of all flow measurement devices or shall report on their failure to be accurate.

G. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in a manner recommended by the original Installer.

H. Make all final readings for each system at the same time, and after all adjustments have been made.

I. Mark equipment settings, including damper control positions, balancing cocks, circuit setters, valve indicators, fan speed control settings and similar controls and devices, to show final settings at completion of test-adjust-balance work.
   1. Mark with paint or other suitable permanent identification material.
J. Check all new thermal overloads.
   1. Identify improperly protected equipment in report.

3.2 AIR SYSTEMS

A. Scope: All air systems are to be balanced.

B. Before any adjustments are made, check for:
   1. Dirty filters, coils, or air intakes
   2. Duct leakage
   3. Filter leakage
   4. Damper leakage, or blockage
   5. Equipment vibrations
   6. Correct damper operation

C. Simulate a pressure drop across filters equal to that when 50% loaded with dust.
   1. Check fan motor amps with clean filters and simulated loaded filters, and report.

D. Procedure:
   1. Measure and report the following for all supply, return, exhaust, and outside air systems:
      a. Individual air inlets and outlets.
      b. Pitot traverses of main supply, return, exhaust and outside air ducts.
      c. Rotating valve or velocity grid traverse of coils or filters.
      d. Plot operating point on fan curve. Include compensation for effects of altitude and inlet vanes.
   2. Above measurements shall be made with system in normal, full load condition.
      a. Systems with economizers shall be measured at minimum outside air and 100% outside air.
      b. Systems with 100% outside air capability or evaporative cooling sections shall be measured at maximum outside air.
      c. VAV systems shall be measured at the zone level at maximum air condition, and at the main at the system diversity condition.
   3. Make main duct traverses or coil/filter traverses and report operation at all other operating conditions (as applicable).
      a. Economizer operation
      b. Unoccupied mode
      c. Smoke evacuation mode
      d. Pre-cool mode
      e. Fail over mode
      f. Two-speed fans
      g. All VAV terminals driven to maximum position
   4. Set fan speed such that under no condition will the motor exceed the service factor rating when operating in any of the above possible modes.
5. Measure fan motor amps in each of the above possible operating modes (clean filters).

E. Adjust Air Systems to provide proper air pressure relationships as shown by relative air quantities or as indicated on the drawings.

F. Adjust distribution system for uniform space temperatures free from objectionable drafts and noise.
   1. Division 233300 to provide orifice plates or dampers where required.

G. Exchange sheaves and belts as required to adjust the rpm of all fans so they handle specified air quantity.

H. Set minimum outside air quantities.

3.3 DOMESTIC WATER SYSTEM

A. Scope: Balance all domestic hot water and hot water re-circulation systems.

B. Before any adjustments are made:
   1. Check temperature control device operation (mixing valves, external temperature control devices, etc.)
   2. Check rotation of pumps.
   3. Adjust pressure reducing valves.
   4. Verify proper operation of ASME pressure and temperature relief valves.

C. Using flow meters, adjust the quantity of water circulated by each pump and the flow in each branch of the hot water re-circulation systems.

3.4 DETAILED REQUIREMENTS

A. Measure, adjust and report the following:

   1. Fans:
      a. Inlet and outlet pressure
      b. Air flow
      c. Fan speed
      d. Motor amps and KW

   2. Ductwork Systems:
      a. Air flow at each inlet and outlet.
      b. Blade angles at all adjustable diffusers.
      c. Filter pressure drop.
      d. Outside air percentage at minimum and maximum setting.
      e. Air flow at supply, return, outside air and exhaust mains to determine total air flow.

   3. Coils:
      a. Air flow.
b. Inlet and outlet air static pressure.
c. Inlet and outlet air temperature.
d. Water flow.
e. Inlet and outlet water pressure.
f. Inlet and outlet water temperature.

4. Air-Cooled Condensing Units:
   a. Ambient temperature
   b. Suction and discharge pressure
   c. Oil pressure
   d. Compressor amps and KW
   e. Fan amps and KW

3.5 REPORT

A. Provide a general information sheet listing:
   1. Instruments used:
      a. Most recent calibration date.
   3. Altitude correction.
   4. Manufacturer’s performance data for all air devices used.

B. Provide data sheets for all equipment, including motors and drives, listing:
   1. Make
   2. Size
   3. Serial number
   4. Capacity Rating
   5. Amperage
   6. Voltage input
   7. Thermal heater size for each motor
   8. Operating speed of driver and driven devices
   9. Any additional pertinent performance data

C. Include design and final values for all items listed in Detailed Requirements, and totals for each system.

D. Provide data sheets showing:
   1. Air flow at each inlet and outlet
   2. Instrument used
   3. Velocity reading
   4. Manufacturer’s free area factors

E. Provide recap sheet with explanation for each device not meeting specified performance.

F. Provide a set of prints with equipment, inlets and outlets marked to correspond to data sheets.

END OF SECTION 230593
PART 1 - GENERAL

1.1 SUBMITTALS
A. Submit manufacturer’s product data on the following:
   1. Insulation.
   2. jackets, coatings and protective finishes.
   3. sealers, mastics and adhesives.
   4. fitting covers.
   5. manufacturer’s installation details for fire rated duct wrap.

1.2 FLAME AND SMOKE RATINGS
A. Provide insulation tested on a composite basis (insulation, jacket, covering, sealer, mastic and adhesive) complying with the following:
   1. Flame Spread: 25 or Less
   2. Smoke Developed: 50 or Less
   3. Method: ASTM E84 (NFPA 255)

1.3 PRODUCT DELIVERY
A. Deliver insulation products in factory containers bearing manufacturer’s label showing fire hazard rating, density and thickness.

1.4 DEFINITIONS
A. Exposed Location: Located in mechanical rooms or other areas exposed to view.
B. Concealed Location: Located in pipe chases, furred spaces, attics, crawl-spaces, above suspended ceilings, or other locations not exposed to view.

1.5 STANDARDS
A. Comply with the latest edition of National Commercial and Industrial Insulation Standards.
B. Comply with ASHRAE 90.1 – 2007.

PART 2 - PRODUCTS

2.1 PIPE INSULATION
A. Manufacturers:
   1. Design Basis: Johns-Manville
2. Other Acceptable Manufacturers:
   a. Armstrong
   b. Owens-Corning
   c. Knauf
   d. Nomaco
   e. Imcoa
   f. Cell-U-Foam

B. Materials:
   1. Fiberglass Pipe Insulation: Johns-Manville Micro-Lok heavy density pipe insulation with AP-T jacket.
   3. Flexible Unicellular Pipe Insulation: Armstrong Armaflex, II or Therma-cel By Nomaco.

C. Thickness: (Thickness listed below are minimum required. Provide thickness required by Local Building or Energy Codes).
   1. Service (Domestic) Water Piping:
      a. Hot:
         1) 2” and Smaller: 1”
         2) 2-½” and Larger: 1 ½”
         3) Runouts up to 2” and 10 feet long: ½”
      b. Cold: 1”
   2. Refrigerant Suction and Hot gas Bypass Lines:
      a. Size 2-1/8” and smaller: ½”
      b. Size 2-5/8” and larger: ¾”
   3. Refrigerant Liquid Lines:
      a. All Sizes: ½” (1” for fiberglass)
   4. Condensate Drain Piping:
      a. All sized: ½” (1” for fiberglass)

D. Application: Unless otherwise indicated, use the following: Ductwork is primarily lined as noted in section 15890. This Division shall coordinate exceptions to liner requirements and provide insulation in accordance with the following.
   1. Inside, above ground: Fiberglass.
   2. Inside exposed: Fiberglass with PVC jacket (jacket not required in mechanical rooms).
   4. Outside, exposed to weather: Rigid closed cell with aluminum jacket.
5. Below grade or slab:
   a. Pipe size 1½” and less: Single piece of flexible closed cell insulation slipped over soft annealed copper tube without slitting insulation.
   b. Pipe size 2” and larger: Rigid closed cell insulation with shrink fit jacket.

6. Piping inside air handling units: Provide 1” greater thickness than described above. Provide PVC jacket.

2.2 DUCT INSULATION

A. Manufacturer:
   1. Design Basis: Johns Manville
   2. Other Acceptable Manufacturers:
      a. Certainteed
      b. Knauf
      c. Owens-Corning

B. Materials:
   1. Flexible Faced fiberglass Ductwork Insulation: Johns-Manville Microlite, with FSK factory applied foil-scrim-kraft facing.
   2. Rigid Fiberglass Ductwork Insulation: Johns-Manville 800 Series, Spin-Glas Type 814, 3 lb. Density rigid board with FSK jacket.
   4. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles, and similar accessories as recommended by the insulation manufacturer for the applications indicated.
   5. Cellular glass: Pittsburgh Corning with vapor barrier.

C. Application:
   1. Insulate all exposed unlined supply ductwork with 1” thick rigid fiberglass.
   2. Insulate all concealed unlined supply duct with 1-½” thick flexible, faced fiberglass.
   3. Insulate all exposed unlined ductwork, transporting outside air with 1” thick rigid fiberglass.
   4. Insulate all concealed unlined ductwork, transporting outside air with 1½” thick flexible fiberglass.
   5. Insulate all exposed unlined return air duct with 1” thick rigid fiberglass.
   6. Insulate all concealed unlined return air ductwork with 1½” flexible fiberglass, with or without facing.
   7. Where energy codes require additional insulation over that listed above, provide insulation in accordance with those codes.

D. Duct Liner:
   1. See Section 23 31 13, for duct liner requirements. Supply, return and outside air ductwork that is not lined is to be externally insulated.
2.3 EQUIPMENT INSULATION

A. Manufacturer:

1. Design Basis: Johns Manville
2. Other Acceptable Manufacturers:
   a. Armstrong
   b. Certainteed
   c. Owens-Corning
   d. Knauf
   e. Pittsburgh Corning

B. Materials:

1. Model: Pipe and tank insulation.
   Description: Flexible board type insulation. 3 PCF glass fiber insulation with all purpose jacketing. Maximum thermal conductivity .32 BTU-IN/(hr-FT²-ºF) at 150°F. Glass fibers oriented such that insulation will conform to rounded shapes while maintaining high compressive strength.
   Description: 3 PCT density rigid glass fiberboard, with all purpose jacketing. Maximum thermal conductivity .27 BTU-IN/hr-FT²-ºF).
3. Jacketing Material: PVC or aluminum jacketing material, except as otherwise indicated. Seal all joints.
6. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors, stud pins, metal covers, adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify acceptability of all materials which are to be used in air plenums (above ceiling, etc.). Materials must meet all requirements of Local Building Code and Authority having jurisdiction.

3.2 PIPE INSULATION

A. Insulate the following:

1. Domestic hot water piping.
2. Domestic cold water piping above ground and under slab.
3. Refrigerant suction lines.
4. All existing piping which is currently insulated and which is modified as a result of this work.
5. Condensate drain piping.
B. Installation:

1. Install insulation on pipe system subsequent to testing and acceptance of tests.
2. Install insulation materials with smooth and even surfaces.
   a. Insulate each continuous run of piping with full length units of insulation, with a single cut piece to complete the run.
   b. Do not use cut pieces or scraps abutting each other.
3. Clean and dry pipe surfaces prior to insulating.
   a. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
4. Extend piping insulation without interruption through pipe clamps, hangers, walls, floors and similar piping penetrations, except where otherwise indicated.
5. Install protective metal shields and saddles where needed to prevent compression of insulation. Refer to Section 23 05 29.
6. Except as noted, cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run.
   a. Install factory-molded, pre-cut or job-fabricated units (at Installer’s option), except where a specific form or type is indicated.
   b. Do not cover:
      1) Valve operators.
   c. Provide removable access for:
      1) Strainers.
      2) Other components requiring access for service.
7. Mark location of unions and flanges covered by insulation with permanent paint or ink, or approved label.
8. Maintain integrity of vapor-barrier jackets on insulation of cold pipes and storm drainage piping, and protect to prevent puncture or other damage.
10. Seal ends of sections with vapor barrier cement to create moisture dams at:
    a. 21 ft. intervals.
    b. Valves and fittings.
    c. All hangers and supports.
11. On underground pipe insulation, install unicellular insulation on pipe without slitting insulation.
    a. Seal all transverse joints with adhesive.
12. Replace existing insulation removed or damaged because of work of this project.
13. Insulate new pipes and replace insulation on existing pipes to remain where insulation was removed or damaged by demolition or revisions.
14. Do not insulate basket access flange of flanged strainers.
15. Do not insulate steam traps.
16. Insulate between fingers of spiders in alignment guides.
17. Insulate between pipe and pipe slide.
18. Perform all work in a neat and workmanlike manner. Poor work (as determined by Architect or Engineer) will be cause for rejection.
19. Insulate all acid waste/vent pipe in return air plenums with Armstrong AP Armaflex.
20. All heat exchangers and steam valves to be provided with Velcro crossing removable insulation jackets.
21. All insulated piping exposed to view (excluding mechanical rooms) shall have PVC jacketing.

3.3 DUCTWORK INSULATION

A. Install insulation materials with smooth and even surfaces.
B. Clean and dry ductwork prior to insulating.
   1. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
C. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.
D. Except as otherwise indicated, do not insulate lined ducts. However, extend duct insulation 12” beyond start of lining where lined ductwork meets insulated ductwork.
E. Maintain integrity of vapor-barrier on insulation of ducts carrying cold air, and protect it to prevent puncture and other damage.
F. For Outdoor Insulation:
   1. Stagger joints on multilayer applications.
   2. Locate joints at sides of ducts whenever possible.
   3. Use 520 adhesive to attach insulation.
      a. Use full coverage.
   4. Seal all seams and joints with adhesive.
   5. Maintain full thickness at standing seams and flanges by additional layer(s).
   6. Cover flexible connections.
   7. Extend covering to inside face of outside wall.
   8. Finish with two coats of Armaflex finish.

3.4 EQUIPMENT INSULATION

A. Install insulation materials with smooth and even surfaces and on clean and dry surfaces.
   1. Re-do poorly fitted joints.
   2. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
B. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
C. Apply insulation using the staggered joint method for both single and double layer construction, where feasible.
   1. Apply each layer of insulation separately.
D. Do not insulate handholes, cleanouts, ASME stamp and manufacturer’s nameplate.
   1. Provide neatly beveled edge at interruptions of insulation.

E. Domestic Water Tanks:
   1. Insulate domestic hot water tanks with 2 inches of pipe and tank insulation of 1½ inches of rigid fiber glass board (if not originally insulated from the factory).

3.5 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily. Including units with vapor barrier damage and moisture saturation.

B. Protection: The insulation installer shall advise the Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 230700
PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Installer: A firm with at least five years of successful installation experience on projects with refrigerant piping similar to that required for this project.

1.2 REGULATORY/REQUIREMENTS

A. Comply with applicable requirements of the Clean Air Act, State of Colorado and City and County of Boulder Regulations concerning handling of refrigerants.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Type ACR copper tube with wrought copper fittings.

B. End Caps:

1. Provide factory applied plastic end caps on each length of pipe and tube.
2. Maintain end caps through shipping, storage and handling as required to prevent pipe end damage and eliminate dirt and moisture from inside of pipe and tube.

2.2 SHUT-OFF VALVES

A. Manufacturers:

1. Design Basis: Henry
2. Other Acceptable Manufacturers:
   a. Mueller
   b. Superior
   c. Imperial

B. Size 7/8 Inch and Smaller:

1. Model: Series 600.
2. Type: Pack-less diaphragm.
5. Servicing: Diaphragm changeable under line pressure.

C. Size 1-1/8 Inch and Larger:

2. Type: Wing cap, back seating.
2.3 FLEXIBLE PIPE CONNECTORS

A. Manufacturers:

1. Design Basis: Mason
2. Other Acceptable Manufacturers:
   a. Metraflex
   b. Flexonics

B. Braided bronze with copper tube ends, compatible with refrigerant type for system

C. Flexible connector shall be line size or connection size, whichever is larger.

2.4 REFRIGERATION SPECIALTIES

A. Filter Drier:

1. Conform to ARI Standard 710.
2. Sizes ½” and larger - interchangeable core, full flow.
3. Sizes smaller than ½” - sealed type.
4. Minimum burst pressure - 1500 psig.

B. Sight Glass:

1. Double port moisture indicating, reversible color indicator.
2. Removable sight glass and moisture indicating element.
3. Furnish with a protective cover.

C. Expansion Valve:

1. Thermostatic type, diaphragm or bellows operated.
2. External superheat adjustment factory set for 10ºF superheat (adjustable).
3. Compatible with refrigerant type for the project.
4. Pressure rated per project requirements.
5. Power elements and valve size shall be as recommended by the manufacturer, for the service intended.

D. Solenoid Valve:

1. Provide solenoid valve for systems 25 tons and larger.
2. Compatible with refrigerant type for the project.
3. Valve shall fail in closed position (power open).

E. Acceptable Manufacturers:

1. Alco
2. Sporlen
PART 3 - EXECUTION

3.1 INSTALLATION

A. Run piping level or plumb, except slope gas piping to compressor with a minimum number of elbows.

B. Provide oil traps at bottom of suction risers. Size risers for proper oil return.

C. Size lines for total pressure drop not to exceed 2ºF saturation temperature.

D. Provide necessary flexibility for vibration and expansion with offsets and loops, not expansion joints.

E. Provide flexible connectors at all unit connections.

F. Replace air in pipe with dry nitrogen to prevent corrosion during soldering.

G. Install valves, sight glasses, filter-driers, and accessories, furnished by equipment supplier, but not factory installed.

H. Insulate all underground refrigerant lines with ½" flexible foam.
   1. Use un-slit covering.
   2. Carefully cement all joints.

3.2 HANGERS

A. For insulated piping, provide hangers of size to fit outside insulation.

B. For non-insulated piping, provide hangers with elastomer insert to prevent damage to piping from vibration.

3.3 TESTING AND DEHYDRATION

A. Use the following procedure to test and hydrate the systems:
   1. Isolate any elements which would be damaged by test pressures.
   2. Test system with trace gas using an appropriate leak detector.
   3. Repair or replace leaking elements of system and re-test.
   4. After system has been proven to be free of leaks, evacuate it with a high efficiency vacuum pump to 2.5 mm of mercury absolute.
   5. Allow the system to stand under vacuum for 24 hours.
      a. Then, if a vacuum of 2.5 mm can be drawn within 30 minutes, the system shall be considered dry.
      b. If not, the procedure shall be repeated.
   6. Break the final vacuum by charging with the correct refrigerant.

END OF SECTION 232300
SECTION 233113 DUCTWORK

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

A. Comply with SMACNA (Sheet Metal and Air Conditioning Contractors National Association) recommendations for fabrication, construction and details, and installation procedures, except as otherwise indicated.

B. Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), except as otherwise indicated.

C. Comply with SMACNA “HVAC Air Duct Leakage Test Manual” for testing of duct systems.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings for:
   1. Transition elbows.
   2. Seal and reinforcing schedule for all ductwork fabrication types.
   3. Turning vane and turning vane installation.

B. Product Data: Submit manufacturer’s product data on the following:
   1. Duct lining.
   2. Duct lining adhesive.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. All interior ducts shall be constructed with G-90 or better galvanized steel (ASTM A653/653M) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (i.e. kitchen exhausts) shall also be G-90 or better galvanized steel LFP, chem treat.

B. Stainless steel duct shall be fabricated from lock forming grade, 300 series, ASTM-A167, No. 4 general purpose finish. Protect finish with mill applied adhesive protective plastic/paper throughout construction.

C. Aluminum duct shall be fabricated from lock forming grade, ally 3003-HI4, ASTM B209. Reinforcing angles, bars, tie rods, and other structural members shall be alloy 6061-T6. Hangers shall be 6061-T6 aluminum, or galvanized or painted steel with a dielectric isolation pad between the dissimilar metals.

D. PVC coated ductwork shall be fabricated from galvanized steel, cleaned and primed with a baked on PVC coating. PVC coating shall be minimum 0.035 lbs./Sq. Ft. at 5 Mills, 90 units a scale shore durometer, flame spread rating 25, smoke developed 50, UL 181, Class I duct. Provide compatible touch up paint to repair damage.

E. Ungalvanized carbon steel shall be lockforming grade, hot rolled steel conforming to ASTM A366 or A619.
2.2 RECTANGULAR DUCT

A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA “HVAC Duct Construction Standards Metal and Flexible” 1995 Edition. All ductwork must comply with all local, state and federal code requirements.

B. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.

C. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.

D. Formed on flanges (T.D.C./T.D.F./T-25A/T-25B) shall be constructed as SMACNA T-25 flanges, whose limits are defined on Page 1.36 1995 SMACNA Manual, First Edition. No other construction pertaining to formed on flanges, will be accepted. Formed on flanges shall be accepted for use on ductwork 42" wide or less, 2" static (positive) or less and must include the use of corners, bolts and cleat.

E. Ductmate type systems that use a butyl Rubber Gasket which meets Mil-C 18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657 must also pass UL-723. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth (as defined in 21CFR 177, 1210 closures with sealing gaskets for food containers).

F. Aluminum duct shall be fabricated using the aluminum thickness equivalence table in the standard. Simply increasing the thickness by two gauges is not acceptable.

G. Fittings shall be constructed and reinforced as ductwork according to the longest span.

2.3 ROUND AND OVAL DUCT

A. Round and oval duct shall be galvanized steel, constructed in accordance with Section III of the 1995 SMACNA “Duct Construction Standards, Metal and Flexible”, except as noted.

1. Lighter gauge factory made duct with an Intermediate standing rod may be used. Submit product data sustaining the equivalency of such duct into SMACNA standard duct.

B. Minimum duct gauge shall be 26 gauge.

C. Round ductwork shall be spiral lock seam construction only. Longitudinal seam duct is not acceptable. Gauges shall be in accordance with SMACNA Duct Construction Standard and fittings in accordance with SMACNA Duct Construction Standard, except as noted:

1. Joints 0"-20" diameter, interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint before assembling and after fastening. Wrap joints with 3-inch wide duct tape.

2. Joints 21"-72" diameter, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.
3. Joints 73” diameter and up, use companion angle flanged joints only as defined on page 3-6 of the SMACNA Manual. Refer to manual for proper sizing and construction details. Ductwall to be welded longitudinal seams.

D. Fittings shall be continuously welded, standing seam, or spot welded and sealed. Metal thickness and reinforcing shall be equivalent to the requirements of the largest span.

   1. All elbows greater than 45” shall be radius type, R=1.5 times duct diameter.
   2. Elbows less than 12” shall be of die stamped construction. Elbows 12” or greater shall be 5-gore construction.
   3. Diverging and converging flow fittings shall be constructed with no excess material projecting from the body into the branch tap entrance. All such fittings shall be 45° “shoe” entrance, wye plus elbow, or 45° lateral branch. Special fittings such as heel tapped elbows and bullhead tees may be used only where shown on drawings. Adjustable elbows and straight saddle taps shall not be used. Low pressure adjustable elbows acceptable. Conical tees may be used on round ductwork.

2.4 ROUND AND OVAL DUCT

A. Construction:
   1. Galvanized steel spiral lock formed.
   2. Elbows:
      a. 6” Diameter and Less: Die formed.
      b. Above 6” Diameter: 5 piece.

2.5 VAPOR LADEN DUCT

A. Material: 22-gauge aluminum.

B. Seams: Seal all seams watertight.

C. Drainage: Run duct vertical or pitch toward hood.

2.6 CONTRACTOR FABRICATED CASINGS AND PLENUMS

A. Unless required otherwise by drawings, single wall casings and plenums may either be contractor or factory fabricated where shown on drawings. All double wall casings and plenums shall be factory fabricated.

B. Casings and plenums shall be constructed in accordance with the 1995 SMACNA “HVAC Duct Construction Standards” and as specified below.

C. All casings and plenums on the suction side of any fan, including return air outside air, or mixing plenum shall be constructed to 2” negative pressure class.

D. Louver blank-off panels shall be constructed to 2” negative pressure class.

E. All casings and plenums for relief and exhaust air shall be 2” positive or negative pressure class.
F. All casings and plenums on the discharge side of supply fans shall be 4” positive pressure class.

G. Single wall plenums shall be of the standing seam type construction. Submit shop drawings indicating overall dimensions, support details, corner & edge details, penetration details, equipment installation details, and pressure class.

H. Seal all seams, edges, and corners with approved duct sealant.

I. Casing materials shall be the same as that for the connected duct systems.

J. Where automatic dampers may, completely shut off air flow and subject plenum of casing to fan close off pressure, install pressure relief panels, rated to open at 125%.

2.7 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of the types an sizes indicated, and where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Single wall splitter and turning vanes shall be custom fabricated as specified below.

C. Ductwork Support Materials: Except as otherwise indicated, provide galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

D. Duct Liner:
   1. Manufacturers:
      a. Design Basis: Johns-Manville
      b. Other Acceptable Manufacturers:
         1) Certainteed
         2) Owens Corning
   2. Model: Minimum 1-1/2” (2” in Plenums) Linacoustic HP or Permacoat with EPA registered antimicrobial coating, in accordance with UL 181, ASTM C1071, G21 and G22 with no observed growth.
   3. Compliances:
      a. FSHH-1-545, Type I
      b. NFPA 90-A
   4. Roughness: 0.0008 feet
   5. Noise Reduction Coefficient: 0.85 or higher for 1-1/2” liner
   7. Density: 3 lbs/cubic feet for 2” line.

E. Duct Liner Adhesive:
   1. Manufacturers:
      a. Design Basis: Childers
b. Other Acceptable Manufacturers:
   1) King
   2) Hardcast
   3) Ductmate Industries, Inc., PROTrack

2. Model:
   a. Indoor/Outdoor: CP-127 Chil-Quik

F. Duct Sealant:

1. Manufacturers:
   a. Design Basis: United McGill
   b. Other Acceptable Manufacturers:
      1) Ductmate Industries, Inc., PROSeal
      2) 3M
      3) Precision

2. Model:
   a. Indoor: United Duct Sealer
   b. Outdoor: Unicast

3. Description: Non-hardening, liquid or mastic elastic sealant.

G. Duct Tape Sealing System:

1. Manufacturers:

2. Model:
   a. Tape: DT
   b. Indoor Adhesive: FTA-20
   c. Outdoor Adhesive: RTA-50

H. Acoustical Duct Lagging:

1. Manufacturers:
   a. Design Basis: Sound Seal
   b. Other acceptable manufacturers:
      1) Kinetics Noise Control
      2) The Proudfoot Company
      3) Acoustical Solutions

   c. Model: B-10 LAG/QFA-3, foil face loaded vinyl or lead barrier sheet fully bonded to a minimum 1" thick fiberglass blanket, nominal density of 1.0psf, install so jacket edges overlap by minimum of 6", minimum STC-27 tested by independent
laboratory in accordance with ASTM E90 and E413, minimum insertion loss (IL) value at 500Hz shall be 23 and meets IMC flame/smoke ratings in accordance with ASTM E84.

I. Fiberglass ductboard is permitted for sound boots. Fiberglass ductboard is not acceptable at any other locations.

J. Access doors shall be hinged or Ductmate Sandwich Type Access Doors manufactured by Ductmate Industries, Inc. Doors shall be of adequate size to allow easy access to hardware, which needs to be maintained.

K. Flexible Duct Connector:
   1. Flexible duct connector shall be used where ductwork connects to fans of apparatus, or apparatus casing to fans. Provide 1” slack.
   2. Connectors will meet NFPA 90A and 90B specifications and provide an airtight and waterproof seal.
   3. Indoor installations shall be Neoprene or vinyl coated fabrics.
   5. Connector shall be Ductmate PROFlex or approved equal.

L. Description: Piping on roof shall be supported by an engineered prefabricated portable pipe system specifically designed to be installed on the roof without roof penetrations, flashing or damage to the roofing material. The system shall consist of recycled rubber or plastic bases, hot dipped galvanized or stainless steel frame with threaded rods and suitable pipe hangers and supports. The system shall be custom designed to fit the piping and conduits to be installed and the actual conditions of service.

M. Provide seismic restraints as required for seismic zone. See 23 05 49.

2.8 FABRICATION

A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA “HVAC Duct Construction Standards Metal and Flexible” 1995 Edition. This shall be subsequently referred to as the SMACNA Manual. All ductwork must comply with all local, state and federal code requirements.

B. See schedules for external pressure requirements. All pressures above 2” esp. shall be medium pressure.

C. All low pressure ductwork is to be constructed for 2” W.C. positive and 1” negative static pressure and 2000 FPM.

D. All negative pressure ductwork shall be constructed for 2” W.C. negative and 2” W.C. positive static pressure and 2000 FPM velocity.

E. All grease-laden negative pressure ductwork shall be constructed for 4” W.C. negative static pressure and 3000 FPM velocity.
F. Make all changes in direction using 1.5 radius elbows where possible. Use mitered rectangular elbows with turning vanes otherwise.

1. Use single thickness splitter vanes for all radius elbows less than 1.5
   \[ D = r \]
   a. \( D \) = diameter of duct or width of duct (in plane of change-in-direction).
   b. \( r \) = radius of duct at duct center-line.
   c. Use “Curve Ratios” of 0.45 or greater (as defined by figure 3-7 of the 1989 ASHRAE Fundamentals Handbook).

2. Use single thickness turning vanes with no trailing edges in accordance with SMACNA Standards.
   a. All mitered, rectangular elbows.
   b. All rectangular elbows greater than 36” in width provide support rails.

G. Fabricate transition elbows with turning vanes at correct angle so entering and leaving edges are parallel or tangent to air flow.

H. All branch duct take-offs shall use 45° laterals or 45° “pants-leg” type fittings.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

A. Assemble and install ductwork in accordance with recognized industry practices, which will achieve air-tight and noiseless systems, capable of performing each indicated service.

B. Install each run with a minimum of joints.

C. Where ducts pass expansion joints or structural elements subject to movement provide flexible connections and supports to allow for movement without adverse effects.

D. Align ductwork accurately at connections, within 1/8” misalignment tolerance and with internal surfaces smooth.

E. Support ducts rigidly with suitable ties, braces, hangers and anchors of the type, which will hold ducts true-to-shape to prevent buckling. This Division is responsible for all duct supports.

F. Seal ducts in accordance with SMACNA requirements for pressure class indicated.

   1. Indoor Ducts: Use liquid or mastic sealant, or tape system.
   2. Outdoor Ducts: Use tape system.
   3. Approved manufactured joining systems with gaskets may be used in lieu of transverse sealing.

G. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible.
H. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of the building.

1. Limit clearance to 0.5” where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.
2. Where possible, locate insulated ductwork for 1.0” clearance outside of insulation.

I. In finished spaces, conceal ductwork by locating in mechanical shafts, hollow wall construction or above suspended ceilings.

J. Where possible, avoid locating ducts on or near floor.

1. Where ducts must be located low, provide metal trestle to protect duct at places where duct will be climbed over.

K. Coordinate the layout with suspended ceiling and lighting layouts and similar finished work.

L. Install access doors where necessary for inspection and maintenance.

1. Provide additional 12” x 12” access door at each damper, with 6” x 8” wire mesh glass view port.
2. Arrange access doors so that:
   a. They open against the system air pressure wherever feasible.
   b. Their latches are operable from either side, except where the duct is too small to be entered.

M. Where ducts pass through non-fire-rated interior partitions below ceiling and exterior walls:

1. Conceal the space between the construction opening and the duct or duct-plus-insulation with sheet metal flanges of the same gauge as the duct.
2. Overlap the opening on all sides by at least 1-1½”.

N. Provide volume dampers at branch take-offs (except upstream of VAV boxes which should not have dampers).

O. Provide conical or tapered taps with balancing dampers on all round ductwork takeoffs (except upstream of VAV boxes, which should not have dampers).

P. Where space permits, round or oval ductwork of equivalent diameter may be substituted for unlined rectangular ductwork.

Q. Provide 22-gauge aluminum ductwork for the first 20 feet downstream of any aluminum grille. Slope duct towards grille at 1/8” /ft.

3.2 DUCT LINER INSTALLATION

A. Line ductwork as indicated below:

1. Use 1-1/2” thick lining except where noted otherwise (2” in plenums).
2. Dimensions indicate inside free area.
3. Line all supply ductwork, downstream of VAV boxes and low pressure ductwork.
4. Line all return ductwork.
5. Line all outside air ductwork.
   a. Concealed outdoor air duct may be lined at contractor’s option although it must be coordinated with insulation contractor and Section 23 07 00.

B. Ducts Exposed to Weather: Line all low velocity ducts exposed to weather with two inch thick lining.
   1. Dimensions indicate free area.
   2. Seal ducts to three-inch static pressure standards.

C. Supply, return or outside air ductwork, which is not lined (as noted above) is to have exterior insulation. See Section 23 07 00 for insulation requirements on unlined ductwork.
   1. Coordinate lined duct and insulated duct prior to bid.
   2. Coordination of extent of liner or insulation, after bid award, shall be as directed by Engineer at no additional cost to Owner.

D. Seal all exposed ends of liner with duct liner adhesive back a minimum of 2” from ends. Seal all joints in liner a minimum of 1” overlap. Seal all fasteners.

E. Completely remove any loose material from each section of lined ductwork as it is installed.

F. Interrupt duct liner a minimum of 18” upstream and 30 inches downstream of all electric resistance heaters in duct system. If ductwork is used for cooling, wrap that portion of duct which is not lined and extend insulation a minimum of 12” beyond lining in each direction.

3.3 DUCT LEAKAGE TESTING

A. Installed ductwork shall be tested prior to installation of access doors, take-offs, etc.

B. All leak testing shall be witnessed by the Engineer or representative of the Engineer. The Contractor shall give the Engineer 72 hours notice prior to testing. Any testing not witnessed by the Engineer or his/her representative, shall be considered invalid and will be redone.

C. The testing shall be performed as follows:
   1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
   2. Use a certified orifice tube for measuring the leakage.
   3. Define section of system to be tested and blank off.
   4. Determine the percentage of the system being tested.
   5. Using the percentage, determine the allowable leakage (cfm) for that section being tested.
   6. Pressurize to operating pressure and repair any significant or audible leaks.
   7. Repressurize and measure leakage.
   8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

   NOTE: It is recommended that the first 100’-300’ of ductwork installed be tested to insure the quality of the workmanship at an early stage.

D. All transverse joints and longitudinal seams shall conform to SMACNA’s Class A sealing requirements as defined on page 1-6 of the 1995 SMACNA Manual, First Edition.
E. Constant Volume Systems/Supply Ductwork  
Allowable Leakage  
1% of design cfm

F. Constant Volume Systems/Return Ductwork  
Allowable Leakage  
2% of design cfm

G. Variable Air Volume Systems/Supply Ductwork  
Fan to VAV Boxes  
1% of design cfm

VAV Boxes to Registers  
2% of design cfm

H. Variable Air Volume Systems/Return Ductwork  
Allowable Leakage  
2% of design cfm

3.4 DUCTWORK STORAGE AND CLEANING

A. Cleaning:
   1. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris.
   2. Clean external surfaces of foreign substances which might cause corrosion of metal or deterioration of paint.

B. Protection:
   1. Store duct a minimum of 4” above ground or floor to avoid damage from weather or spills.
   2. Cover all stored ducts to protect from moisture or debris.
   3. Cover all ends of installed ductwork at the end of each workday or when dust and debris producing construction (such as fire proofing, drywall, sanding, or core drilling) is occurring.

C. Ductwork contaminated or damaged above “shop” or “mill” conditions shall be cleaned, repaired or replaced to the Engineer’s satisfaction.
   1. Ductliner pre-installed in stored duct which has become wet may be installed if first allowed to completely dry out.
   2. Ductliner in installed ductwork, which has become wet must be completely removed and replaced.
   3. Torn ductliner may be replaced by coating with adhesive if damaged is minor and isolated. Extensively damaged liner shall be replaced back to a straight cut joint.

END OF SECTION 233113
PART 1 – GENERAL

1.1 INDUSTRY STANDARDS

A. Comply with SMACNA (Sheet Metal and Air Conditioning Contractors’ National Association) latest recommendations for fabrication, construction and details, and installation procedures, except as otherwise indicated.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data on the following:

1. Flexible duct
2. Ceiling dampers
3. Fire dampers
4. Smoke dampers
5. Louvers
6. Sound attenuators

PART 2 - PRODUCTS

2.1 FLEXIBLE DUCT ACOUSTICAL

A. Manufacturers:

1. Flexmaster Type 8M, or equal.

B. Construction:

1. CPE Liner film mechanically locked without adhesives.
2. Insulation: Minimum 1-½” thick fiberglass blanket with a polyethylene vapor barrier. Map 0.23 ‘c’ factor, factory installed.
3. Helix: Corrosion resistant galvanized steel.

C. Pressure rating: 6” w.g. positive, 1” w.g. negative at maximum 180°F operating temperature.

D. Standards: NFPA90A UL-181, Class I, ASTM E-96 - Procedure A.

E. Insertion loss shall be at least:

<table>
<thead>
<tr>
<th>OCTAVE BAND (Hz)</th>
<th>125</th>
<th>230</th>
<th>400</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6”</td>
<td>7</td>
<td>31</td>
<td>40</td>
<td>38</td>
<td>40</td>
<td>27</td>
</tr>
<tr>
<td>8”</td>
<td>13</td>
<td>29</td>
<td>36</td>
<td>35</td>
<td>38</td>
<td>22</td>
</tr>
<tr>
<td>12”</td>
<td>21</td>
<td>28</td>
<td>29</td>
<td>33</td>
<td>26</td>
<td>12</td>
</tr>
</tbody>
</table>

DB reduction for 10 foot length tested in accordance with ASCME 477.
2.2 LOUVERS

A. Louvers are specified in the Architectural Division. This division is responsible for coordinating all duct connections, damper sizes, etc. with the louvers specified.

2.3 PREFABRICATED CURBS

A. General: Except where curbs are provided with equipment, provide prefabricated curbs for all roof mounted equipment.

B. Manufacturers:
   1. Design Basis: Pace
   2. Other Acceptable Manufacturers:
      a. Thycurb

C. Model for grease-laden exhaust fans: ES-2.
   1. Coordinate to fit vibration isolation rail.

D. Coordinate with roofing Contractor. Exterior insulation, cants, flashing and counter flashing shall be furnished and installed under roofing work, Division 7.

E. Model: As required.

2.4 SOUND ATTENUATORS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Aerosonics
      b. Commercial Acoustics
      c. Industrial Acoustics
      d. Semco
      e. Vibro Acoustics

B. Acoustical Performance
   1. All duct silencer performance data shall be derived from National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory tests in accordance with ASTM E477-99, Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers. Submit certification of acoustical and aerodynamic performance.
2.5 FIRE DAMPERS

A. Manufacturers:
   
   1. Acceptable Manufacturers:
      
         a. Ruskin
         b. Safe-Air
         c. United Sheetmetal
         d. National Controlled Air
         e. Greenheck
         f. Prefco

B. Rating: UL555 dynamic 1-½ hours, or 3 hours, UL555S Class II leakage rated. Match construction penetrated.

C. Size: Metal-to-metal for lined and unlined ducts.

D. Fusible link only. Use Type B “Top Hat” wherever possible.

2.6 FIRE/SMOKE DAMPERS

A. Manufacturers:

   1. Acceptable Manufacturers:
      
         a. National Controlled Air
         b. Johnson Controls
         c. Safe Air
         d. Ruskin
         e. Air Balance
         f. Greenheck
         g. Prefco

B. Fire Damper Rating: UL Standard 555 Dynamic, 1-½ hour or 3 hours.

C. Smoke Damper Rating: UL Standard 555S, Class II.

D. Damper Assembly:

   1. Type: 120 volt.
   2. Listing: UL 555S, UL555.
   5. Heat sensor: 165°F fusible link.
   7. Seals: Mechanically fastened, rated up to 450°F.

E. Where part of Smoke Control System.

   1. Provide end switch for positive indication of damper position.
   2. Provide means to re-open damper remotely in the event thermal link trips. Allow for re-open up to elevated rating of 250°F.
2.7 SMOKE DAMPERS

A. Manufacturers:

1. Acceptable Manufacturers:
   a. Air Balance
   b. Greenheck
   c. Johnson Controls
   d. National Controlled Air
   e. Prefco
   f. Pottorff
   g. Ruskin
   h. Safe Air

B. Smoke Damper Rating: UL Standard 555S, Class II.

C. Operator:

1. Type: 120 volt.
2. Listing: UL Smoke Damper Operator Label.
3. Failure Position:
   a. Smoke control system dampers: As shown on plans.
   b. Others: Closed

4. UL listed modulating actuator at dampers that are part of smoke control system.

D. Blade: Air foil.

E. Seals: Steel.

F. Where part of smoke control system:

1. Provide end switch for positive indication of damper position.

2.8 MISCELLANEOUS DUCTWORK ACCESSORIES

A. Duct Access Doors: Provide duct access doors with gaskets, and with insulation where ductwork is indicated to be insulated.

1. Manufacturer:
   a. Design Basis: Cesco
   b. Model: HAD hinged

2. Other acceptable manufacturers:
   a. Flexmaster
   b. Milcor
   c. Elmdor
B. Flexible Connectors: Fireproof glass cloth, Vent-Fab or approved equal.

1. Manufacturers:
   
a. Design Basis: Vent-Fab
   b. Other Acceptable Manufacturers:
      1) Duro-Dyne

2. Material: Fireproof glass cloth

2.9 BACKDRAFT DAMPERS

A. Construction:

   1. Frame: Extruded aluminum.
   2. Blades: Formed aluminum with extruded vinyl edge seals.
   3. Bearings: Synthetic

B. Performance: 12 cfm per square foot at ½" W.G.

2.10 BALANCING DAMPERS

A. Construction:

   1. Frame: 16 gauge galvanized steel.
   2. Blades: 16 gauge galvanized steel with vinyl edge seals.
   4. Performance:
      
a. Maximum pressure drop in full open position (@3000 fpm): 0.55
   b. Maximum leakage: 32 cfm/sp at 4" W.C.

B. Type: Rectangular balancing dampers are to be opposed blade type with locking handle, unless otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION OF ACCESSORIES

A. Install fire, smoke and ceiling dampers in accordance with manufacturer’s instructions and the latest version of the Fire, Smoke and Radiation Damper Guide for HVAC Systems, published by SMACNA.

B. Install access doors where necessary for inspection and maintenance.

   1. Provide additional 12” x 12” access door at each low leakage damper.
   2. Arrange access doors so that:
      
a. They open against the system air pressure, wherever feasible.
b. Their latches are operable from either side, except where the duct is too small to be entered.

c. Install flexible connectors at all duct connections to rotating or reciprocating machinery or equipment.

3. Provide access doors at all fire damper locations.

C. Notify fire alarm provider of smoke damper control requirements and fire alarm interlocks.

D. Install flexible ductwork without tight bends and free of kinks.

1. Flexible ductwork shall not be less than 4’, nor exceed 6’ in length.
2. Flexible ductwork shall be installed with a “minimum length of straight duct” upstream of the diffuser neck inlet. “A minimum length” shall mean a length equal to three (3) duct diameters. “Straight duct” shall mean the center-line of the duct shall be aligned with a line perpendicular to the plane of the diffuser neck opening at the center point of the opening.
3. Conform to the detail on the drawings.

E. Install all dampers, including those furnished by Section 23 09 00 Contractor.

1. Caulk damper frames to ductwork.
2. Make sure dampers are free to operate properly.
3. Install parallel blade mixing dampers to two streams impinge on each other to facilitate mixing.

F. Provide balance dampers at branch take-off and where required to minimize balancing performed at diffuser face.

G. Provide all balance dampers as shown on plans and any additional dampers necessary to provide a balanced system meeting all sound requirements.

END OF SECTION 233300
PART 1 - GENERAL

1.1 QUALITY CONTROL
   A. Provide fans with AMCA performance certification and label.
   B. Grease exhaust fan shall comply with NFPA 96 and be UL listed.

1.2 MOTOR HORSEPOWER
   A. Do not increase or decrease motor horsepower from that specified without written approval from Architect/Engineer. See Section 23 05 01.

1.3 SUBMITTALS
   A. Manufacturer’s Data: Submit manufacturer’s product data including:
      1. Performance
      2. Size
      3. Type
      4. Options provided
      5. Fan curves
      6. Indicate Compliance with Section 1.1 where applicable.

PART 2 - PRODUCTS

2.1 POWER ROOF VENTILATORS, CENTRIFUGAL
   A. Manufacturers:
      1. Acceptable Manufacturers:
         a. Acme
         b. Cook
         c. Greenheck
   B. Features:
      1. Spun aluminum housing.
      2. Internal rubber vibration isolators.
      3. Ball bearings.
   C. General:
      1. Provide:
         a. Bird screen.
b. Gravity back-draft damper:
   1) 0.2 inches WC max. pd.

c. Motorized type backdraft damper where indicated.

D. Roof Curb:
   1. Curbs will be provided under another Division.
   2. Provide dimension data to Supplier of roof curbs.
   3. Provide factory fabricated roof curb of height required by local authorities.

E. Sound Criteria:
   1. Required sound levels may be attained by use of sound attenuating curbs.
   2. Fan shall have specified capacity with curb in place.
   3. Curb pressure drop is not included in specified ratings.

2.2 IN-LINE CENTRIFUGAL FAN

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Acme
      b. Greenheck
      c. Powerline
      d. Trane

B. Cabinet: Steel, insulated, baked enamel finish.

C. Wheel: Cast aluminum Airfoil, statically and dynamically balanced. Cast aluminum hub.

D. Bearings: Heavy duty pillow black in enclosed duct with external grease fittings.

E. Guards: Belt.

F. Drive: See Schedule.

G. Accessories:
   1. Access panel.

PART 3 - EXECUTION

3.1 NOISE AND VIBRATION

A. Insure that fans are properly supported on vibration isolators. Reference Section 23 05 48 for Vibration Isolation Requirements.

B. Insure that flexible duct connections are properly made.
C. Check fan for improper balance.
   1. Have fan re-balanced if necessary.

D. Check for proper rotation.

E. Check for unusual noise or vibration and correct as necessary.

3.2 ACCESS

A. Provide for proper access to all parts of fan needing inspection or service with access doors in fan or ductwork.

3.3 INSTALLATION

A. Install units level and plumb.

B. Provide necessary auxiliary supporting steel.

C. Mount motor and drives so belts run true.

D. Provide necessary lubrication.

E. Provide flexible duct connections on inlet and discharge.

3.4 CURBS

A. Provide necessary dimensions and details so roof opening can be provided at the proper time.

B. Coordinate delivery of curb with roofing contractor so project is not delayed.

C. Provide a weatherproof installation:
   1. Seal all joints including, but not limited to:
      a. Unit and curb.
      b. Unit and ducts.

END OF SECTION 233400
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units.
B. Variable volume regulators.
C. Integral heating coils.
D. Integral damper motor operators.
E. Integral controls.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 09 00 - Controls and Instrumentation: Thermostats and control components.

1.3 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. UL - Shutoff terminal must be UL listed as a Room Air Terminal.
E. ASTM A 527 (Steel Sheet, Zinc Coated Galvanized)

1.4 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. Shall be calculated at design conditions with the following path attenuation credits:

<table>
<thead>
<tr>
<th>CORRECTION TO OCTAVE BAND SOUND POWER VALUE</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Env Adj</td>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>Mineral Fiber Ceiling Tile</td>
<td>-9</td>
<td>-10</td>
<td>-12</td>
<td>-14</td>
<td>-15</td>
<td>-15</td>
</tr>
<tr>
<td>Space Effect Factor</td>
<td>-10</td>
<td>-11</td>
<td>-12</td>
<td>-13</td>
<td>-13</td>
<td>-14</td>
</tr>
</tbody>
</table>

This transfer function represents modeling assumptions based on ARI 885-90.
C. Submit manufacturer’s installation instructions.

1.5 QUALIFICATIONS

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

1.6 WARRANTY

A. Provide one year manufacturer’s parts warranty.

PART 2 - PRODUCTS

2.1 SINGLE DUCT VAV BOXES

A. Manufacturers:

1. Acceptable Manufacturers:
   a. Trane
   b. Metal Aire
   c. Titus
   d. Enviro-Tec
   e. Carnes
   f. Anemostat
   g. Johnson Controls
   h. Price

B. Sound Criteria:

2. Discharge Sound:
   a. 0.2” SP: NC30
   b. 1.0” SP: NC40
3. Radiated Sound:
   a. 0.2” SP: NC25
   b. 1.0” SP: NC35
4. Sound levels may be attained using attenuators, but pressure drop of attenuator must be included as part of unit pressure drop.
5. Units will discharge into lined ductwork, credit for which cannot be claimed in sound criteria.

C. Duct Connections:

1. Duct connections shown on drawing are minimum.
2. Units with larger connections may be used to meet pressure or sound requirements.
3. Flexible duct shall be same size as unit connection.
D. Construction:
   1. Galvanized steel, one inch lining, conforming to UL181 and NFPA90A.
   2. Maximum leakage not exceeding 1% design flow.
   3. Access door up and downstream of coils.

E. Heating Coils:
   1. Refer to Section 23 82 16 coils.

F. Control:
   1. Electronic, using velocity sensor, with compensation or correction for distorted flow at inlet.
   2. Maximum and minimum volume controls shall be:
      a. Factory set (with allowance for altitude of project).
      b. Accurate within 10%.
   3. Units shall be normally open with reversing relay for use with direct acting thermostat.
   4. Provide electric motor.
   5. Coordinate spring range with Automatic Temperature Control Section.
   6. Coordinate controls on VAV units with control contractor.
   7. Damper control outside of terminal unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

END OF SECTION 233600
PART 1 – GENERAL

1.1 CEILING CONSTRUCTION
A. Provide products compatible with ceiling construction.

1.2 SUBMITTALS
A. Submit catalog data including throw, sound, pressure drop and physical dimensions.

1.3 INDUSTRY STANDARDS
A. Provide products tested in accordance with ASHRAE 70-1991 150 Standard 5219, 150 Standard 3741.

PART 2 - PRODUCTS

2.1 GRILLES AND RECTANGULAR DIFFUSERS
A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Carnes
      b. Krueger
      c. Metal Aire
      d. Anemostat
      e. Titus

B. Material: Steel or aluminum except:
   1. Where noted otherwise.
   2. Where required otherwise for fire rating.
   3. Grilles and diffusers in locker rooms, showers and toilet rooms in locker rooms to be aluminum.

C. Finish: Baked white enamel except where noted.

D. Refer to the Drawings for required performance.

E. Match frame and border types to ceiling system.
2.2 SLOT DIFFUSERS WITH FACTORY-SUPPLIED PLENUMS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Metal Aire
      b. Carnes
      c. Kruger
      d. Anemostat
      e. Titus

B. Material: Steel or aluminum except:
   1. Where noted otherwise.
   2. Required otherwise for fire rating.

C. Finish: Baked white enamel except where noted.

D. Inlet Size: Match duct size.

E. Match frame and border types to ceiling system.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to architectural reflected ceiling plan for exact locations and ceiling types.

B. Exposed mounting screws:
   1. Use tamper proof screws in countersunk holes.
   2. Point screws to match frame.

C. Fire Rated Ceilings:
   1. Provide insulation equivalent to ceiling construction above diffuser between ceiling opening and ceiling damper.

D. Install security type devices in accordance with manufacturer’s directions.

END OF SECTION 233700
PART 1 - GENERAL

1.1 STANDARDS

A. Comply with applicable portions of the following:

1. Safety:
   a. ANSI/ASHRAE 15.
   b. UL 465.


4. Sound: ARI 270.

1.2 SUBMITTALS

A. Submit manufacturer’s data. Include the following:

1. Drawings showing:
   a. Over-all dimensions.
   b. Operating weights.
   c. Support requirements.
   d. Sizes and locations of connections.
   e. Accessories.

2. Performance.

3. Wiring diagrams.

4. Installation instructions.

5. Operating instructions.


7. Parts lists.

PART 2 - PRODUCTS

2.1 RATINGS

A. Based on sea level catalog ratings at 90º ambient.

B. Where ratings are not shown in schedule, refer to cooling unit schedule.

1. Allow two degree suction line drop.

2.2 ELECTRICAL

A. Refer to electrical plans and/or specifications for electrical characteristics.

B. Provide equipment with ampacities not exceeding those of electrical circuits provided.
C. Provide unit(s) for single point electrical connections.

D. The electrical disconnect shall be provided under the electrical division.

2.3 CIRCUITS

A. If more than the specified number of refrigerant circuits are provided, coordinate evaporator circuits for equal number of circuits.

2.4 MANUFACTURERS

A. Design Basis: Trane.

B. Other Acceptable Manufacturers:
   1. Bohn
   2. Lennox
   3. McQuay
   4. TSI
   5. York
   6. Dunham-Bush
   7. Day & Night
   8. Carrier

2.5 CONSTRUCTION

A. Casing: Welded, 18 gauge zinc-coated steel, with exterior phosphatized, primed with epoxy resin and finished with enamel.
   1. Provide removable access panels.

B. Compressor: Hermetic or semi-hermetic with vibration isolators, crank case heater, suction pressure unloading.

C. Condenser Fans: Vertical discharge, direct drive, with permanently lubricated resiliently mounted motors with built-in overload protection.
   1. Provide fan guard.

D. Condenser Coil: Copper tube, aluminum fins with sub-cooling circuit.
   1. Provide grille or louvers to protect coil from hail.

E. Controls: Factory-wired, including:
   1. High and low pressurestats.
   2. Compressor overload devices.
   3. Short cycle timer.
   4. 24 volt transformer.
PART 3 – EXECUTION

3.1 INSTALLATION

A. Locate condensing unit in general position indicated in relation to other work.
   1. Position for sufficient clearance for normal service and maintenance, including clearance for cleaning and replacement of tubes, filters, motor, etc.

B. Charge with refrigerant in the quantity recommended by the manufacturer.
   1. Bleedout non-condensable gases.
   2. Test refrigerant system for leakage in manner recommended by manufacturer.

C. Install pressure relief system in compliance with governing regulations, to vent refrigerant in manner indicated.

D. Install refrigerant piping (Type ACR copper tube) in accordance with manufacturers recommendations, and per the drawings.
   1. Comply with the Clean Air Act.
   2. Provide filter/dryer, site glass and service/isolation valves for each circuit.
   3. Run piping plumb. Slope as required for proper oil return and to protect compressor.
      a. Provide oil trap at bottom of suction risers.

E. Provide for vibration and expansion of piping.

3.2 START-UP

A. Sustained Operation: Do not place unit in sustained operation prior to initial balancing of mechanical systems affected by unit operation.

B. Cooperate with other trades and installers of other work during testing, adjusting, balancing and start-up of mechanical systems.

C. Start up and first year parts and labor to be provided by equipment manufacturer.

END OF SECTION 236213
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Split System DX air handling units.
B. Refrigeration components.

1.2 RELATED SECTIONS

A. Section 23 05 13 – Motors
B. Section 23 40 00 – Air Cleaning

1.3 REFERENCES

D. ARI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard, (equipment greater than 135,000 Btuh).

1.4 QUALITY ASSURANCE

A. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product.

1.5 SUBMITTALS

A. Submit unit performance data including capacity, nominal and operating performance.
B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8 WARRANTY

A. Provide one year parts warranty.

PART 2 - PRODUCTS

2.1 SUMMARY

A. The contractor shall furnish and install air handling units(s) as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. Approved Manufacturers:

1. Trane
2. Carrier
3. York
4. McQuay

2.2 GENERAL

A. Provide indoor-mounted, draw-thru, packaged air handling unit(s). Unit(s) shall be factory-assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

2.3 CASING

A. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a baked enamel finish.

B. Unit casing shall be completely insulated with fire-retardant, permanent, foil-faced, odorless glass fiber material.
2.4 FANS

A. Provide fan section with forward curved, double width, double inlet, centrifugal type fan.

B. Provide self-aligning, grease lubricated, ball or roller bearings with permanent lubrication fittings.

C. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels.

D. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

E. Provide cast iron or steel variable and adjustable pitched sheaves, dynamically balanced, bored to fit shafts and keyed.

2.5 COILS

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil. Enclose coils with headers and return bends fully contained within casing. Coil shall have factory installed expansion valves and factory pressure and leak tested at 375 psig.

B. Provide double sloped condensate drain pan constructed of PVC with external connections on either side of unit. The drain pan shall be removable for cleaning.

2.6 FILTERS

A. Provide one inch throwaway filters, factory installed. Provide access from side panel for removal.

2.7 CONTROLS

A. Provide factory installed and wired controls including fan contactor, low voltage terminal strip and single point power entry.

B. Provide factory installed evaporator defrost control to prevent coil freezing at low evaporator temperatures.

2.8 MISCELLANEOUS FEATURES

A. Thermostats: Provide 24 volt operation control, factory-supplied and field-installed. For specifications see air-cooled condensing unit, section 23 62 13.

B. Vibration Isolators: Provide spring floor-mounted isolators to reduce transmission of noise and vibration to building structures.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install unit on vibration isolators. Reference Section 23 05 48.

END OF SECTION 237324
PART 1 – GENERAL

1.1 WORK INCLUDED

A. The contractor shall summarize and document adherence with the requirements of the specifications for project closeout including:

1. Copies of all warranties
2. Operation & Maintenance Manuals
3. Required tests
4. Test and balance reports
5. Record drawings
6. Permit requirements
7. Valve tag list

B. The contractor shall compile a closeout manual which shall include:

1. A list of all required tests and a place for signoff of date completed.
2. A list of all submittals with dates of acceptance by the engineer.
3. A schedule indicating dates for beginning testing and startup of equipment and dates of tests to be witnessed by the engineer, or designated representative, as required by the specifications.
4. Test procedures to be used for life safety systems.
5. Project closeout check list.

C. The final closeout manual shall include the following:

1. Test reports as required by the specifications with signoff by the appropriate individual (engineer, architect, building official, etc.).
2. Documentation indicating all equipment is operating properly and is fully accessible for maintenance.
3. Copies of all warranties.
4. Test and Balance report.

D. This section only includes the requirements for documentation of the contract documents, by the contractor, for project completion. This section does not in any way decrease the scope of any of the drawings or specifications.

1.2 SUBMITTALS

A. Within 90 days after notice to proceed submit a preliminary closeout manual with the following:

1. A list of all required tests.
2. Preliminary schedule showing major milestones for completion of the mechanical/plumbing systems.

B. Within 30 days of the first major milestone submit the completed closeout manual as described in Part 1.

C. Within 2 weeks of substantial completion submit a completed “Project Closeout Check List”, and the Final Closeout Manual.
D. Listed below is a checklist for use by the contractor. This list is not all inclusive for this project.

Project Close-Out Summary – Mechanical, Plumbing and Fire Protection

☐ All required submittals have been submitted and either been approved or modified in accordance with the Engineer’s “make corrections noted” comments. Our records indicate the following submittals are still outstanding:

☐ Clean filters installed in all units. (Install just prior to building turnover)

☐ All equipment has been started up and is functioning within manufacturers’ recommendations without any undue noise or vibration. (Submit a list of equipment with startup dates. Provide list no later than 120 days prior to project completion date).

☐ All vibration isolation has been installed and is operating properly.

☐ Duct access doors have been installed at fire and fire/smoke dampers and are properly fire-stopped and fire and fire/smoke dampers have been visually inspected to confirm that they are open.

☐ Access doors have been installed as required for concealed equipment, water hammer arrestors, valves, controls, actuators, etc.

☐ All equipment has been installed with the manufacturers recommended service clearances and is fully accessible for required maintenance.

☐ All equipment and piping is labeled per specifications.

☐ All plumbing piping cleaned, flushed and tested per specifications. Submit testing reports for record. Submit letter stating domestic water disinfection (chlorination) has been completed per the specifications.

☐ All action items are complete as listed in the action items reports. Submit a list of action items with sign off by Architect or Engineer for record. Punch list to be completed prior to turn over of building.

☐ Temperature control system complete and tested per specifications.

☐ Test and balance complete and report submitted and accepted by Engineer.

☐ Domestic water and sanitary waste system tested and functional (Super Flush).

☐ Operation and maintenance manuals submitted with table of contents and required documentation for extended warranties.

☐ Factory Testing documented and submitted for record.

☐ Record drawings submitted per specifications.

☐ Temperature Control record documents provided per specifications.

PART 2 – PRODUCTS (Not Used)
PART 3 – EXECUTION

3.1 EQUIPMENT STARTUP AND TESTING

A. Prior to completion and punchlist by the engineer, the contractor shall startup and test each piece of equipment as required by the specifications. The contractor shall provide documentation of all required tests with signoff of by the appropriate individual (engineer, architect, and building official).

3.2 COORDINATION WITH OTHERS

A. The Division 21 through 23 contractor shall coordinate his requirements with the General Contractor to ensure the other building systems are completed to the point that they will not adversely affect the operation of the Division 21 through 23 systems.

3.3 PUNCH LISTS

A. The contractor shall submit in writing that the project is ready for final review by the engineer.

B. Once the project is ready for final review the engineer will create a punch list of any corrections or deficiencies.

C. The contractor shall complete all punch list items and provide a letter to the architect after completion stating all items have been completed or reasons why they were not completed.

D. Upon receipt of this letter the engineer will verify that the punch list has been satisfactorily completed.

END OF SECTION 239000