DESIGN GUIDELINES
AND
CONSTRUCTION STANDARDS
MANUAL

Office of Facilities
Planning and Management
Southern Methodist University

SMU
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As a means to support a vibrant and diverse institution of higher education, Southern Methodist University will continue to provide facilities which promote growth in instruction, research, and campus and student services while maintaining its traditions in architectural form and style. It is this conviction which fosters and creates a demand for new facilities, the adaptation and renovation of existing facilities, and the development of campus planning.

The purpose of the Design Guidelines and Construction Standards Manual is to facilitate and support the improvement and maintenance of a harmonious campus while encouraging architectural innovation and quality construction. This manual is intended to be a fluid document allowing an interpretive expression of the University’s design intent. The University encourages the use of these guidelines and standards as a source of information to develop projects which improve the built environment and promote design and construction professionals to serve as stewards of the University’s resources.

A campus that is both functional and beautiful supports a healthy environment for learning and growth; plays an integral role in attracting and retaining students, faculty, and staff; encourages thinking and collaboration; and promotes pride and ownership in its users. It is the goal of this Manual through its collection of information, details, and diagrams to support these principles.

Michael S. Molina, AIA, NCARB
Associate Vice President and Chief Architect
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FOREWORD

This *Design Guidelines and Construction Standards Manual* (the Manual) has been prepared by the Office of Facilities Planning and Management (FACILITIES) to assist design professionals in understanding the requirements of Southern Methodist University in the planning, design, and construction of University facilities. This *Manual* is intended to be included as an exhibit to the design services agreement.

The information contained in this *Manual* is to be used by Architects, Engineers and Consultants (the Design Team) as an aid in the design of all construction projects undertaken at Southern Methodist University. Design professionals may propose variations that meet or exceed these design guidelines and standards, provided these variations are brought to the attention of the Facilities Project Manager for review and consideration prior to incorporation into the project.

It is understood that this *Manual* is intended to supplement all applicable local, state, and federal codes and other regulatory requirements, and in no way supersedes or takes precedence over the applicable prevailing building codes and regulatory requirements.

Architects, engineers and design consultants engaged by Southern Methodist University shall be fully responsible and liable for their designs and performance – consistent with normal and customary professional standard of care, regardless of the extent to which this Manual is utilized, unless specific design and performance details have been discussed and accepted by Southern Methodist University in writing. The Design Team will be responsible for downloading the most current edition of the *Design Guidelines and Construction Standards Manual*, and ensuring the most current version available is being utilized on the project for which the Design Team has been engaged. The Manual is available at [www.smu.edu/facilities](http://www.smu.edu/facilities).

This *Manual* is a living document and will be periodically reviewed and amended by the Office of Facilities Planning and Management.

END OF SECTION
# ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
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<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
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<td>AIA</td>
<td>American Institute of Architects</td>
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<tr>
<td>AHJ</td>
<td>Authorities Having Jurisdiction</td>
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>ASI</td>
<td>Architect’s Supplemental Instructions</td>
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<td>ASME</td>
<td>American Society for Mechanical Engineers</td>
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<tr>
<td>A/V</td>
<td>Audio/ Visual</td>
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<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
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<tr>
<td>BIA</td>
<td>Brick Industry Association (The)</td>
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<tr>
<td>B&amp;B</td>
<td>Balled and Burlapped</td>
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<tr>
<td>CFM</td>
<td>Cubic Feet per Minute</td>
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<tr>
<td>CMAR</td>
<td>Construction Manager at Risk</td>
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<tr>
<td>CPVC</td>
<td>Chlorinated Polyvinyl Chloride</td>
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<tr>
<td>CSI</td>
<td>Construction Specifications Institute</td>
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<tr>
<td>DAR</td>
<td>Digital Alarm Receiver</td>
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<tr>
<td>DFW</td>
<td>Dallas-Fort Worth</td>
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<tr>
<td>EU</td>
<td>End User</td>
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<tr>
<td>FRP</td>
<td>Fiberglass-Reinforced Polyester</td>
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<tr>
<td>FSC</td>
<td>Forest Stewardship Council</td>
</tr>
<tr>
<td>GMP</td>
<td>Guaranteed Maximum Price</td>
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<tr>
<td>HDPE</td>
<td>High Density Polyethylene</td>
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<tr>
<td>HP</td>
<td>Horse power</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilating, and Air Conditioning</td>
</tr>
<tr>
<td>IPM</td>
<td>Integrated Pest Management</td>
</tr>
<tr>
<td>LEED</td>
<td>Leadership in Energy and Environmental Design</td>
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<tr>
<td>MERV</td>
<td>Minimum Efficiency Reporting Value</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
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</tbody>
</table>
NRC  Noise Reduction Coefficient
NRCA  National Roofing Contractors Association
OAC  Owner- Architect-Contractor
OC  Oversight Committee
OIT  Office of Information Technology
PPD  Preliminary Project Description
PVC  Polyvinyl Chloride
RAS  Registered Accessibility Specialists
RCDD  Registered Communication Distribution Designer
RFI  Request for Information
RFP  Request for Proposal
SA  International Society of Arboriculture
SCL  Sub-Structural Composite Lumber
SMACNA  Sheet Metal and Air Conditioning Contractors National Association
SNL  Special Needs Lighting
STC  Sound Transmission Coefficient
TAS  Texas Accessibility Standards
TCIA  Tree Care Industry Association
TDLR  Texas Department of Licensing and Regulation
THHN  Thermoplastic High Heat Resistant Nylon Coated
THWN  Thermoplastic and Water Resistant Nylon Coated
USGBC  US Green Building Council
VAV  Variable Air Volume
VOC  Volatile Organic Compounds
VCT  Vinyl Composition Tile

END OF SECTION
PART A-1

GENERAL

**Historical Context**

Southern Methodist University (SMU) was founded in 1911, and opened its doors in 1915, with an enrollment of 760 students\(^1\). Today, The main campus sits on 234 acres with 131 buildings, and enrollment of eleven thousand students. Dr. Robert Stewart Hyer was the first President of SMU, and had envisioned SMU “to become a great University and not just a “freshwater college.” He planned the University to consist of a monumental building facing a long boulevard, which would be lined with thirty additional buildings. The buildings were to have the Georgian Architecture style, and all are harmoniously related with red brick and white columns and trim.\(^2\) Dr. Hyer set a high standard for buildings on the SMU campus; he felt that appearance, quality of workmanship, and choice of materials were a necessity to all buildings on the campus. His goal was to construct buildings that would last over one hundred years. To this day, Dr. Hyer’s vision has been maintained with the designs on the SMU main campus by following the Collegiate Georgian architectural style. Hyer was asked after the construction of Dallas Hall, “When will the university be completed, Dr. Hyer?” He replied, “After the City of Dallas is completed.”\(^3\) Dallas Hall was the first building that was built on the SMU campus (1912-1915) and remains its centerpiece today. Hyer resigned as president in 1920. He said, “The president of a tax-supported institution must be a politician; the president of a private institution must be a financier, the president of a denominational university must be both. Since I am neither, I resign.” Hiram Boaz stepped in as the second president. Unfortunately, Boaz quickly passed out of sight as president, and in stepped Charles Selecman. With President Selecman’s determination, he brought nine new buildings to the campus.\(^4\) Selecman’s vision was to make the campus beautiful by planting trees, shrubs, and plants. In 1928, over 600 trees, 1300 shrubs, 1300 hedge plants, and many flowers were planted.

Dallas Hall, Hyer Hall of Science, Fondren Library, Perkins Administration Building, and McFarlin Auditorium formed, and still form, the heart of the campus, and all face inward to the fountain in the center of the quadrangle. “Today’s layout of the quadrangle set on both sides of an axial boulevard running north to a dominant building placed on the axis at the top of slope descends directly from two pencil sketches drawn by Hyer which survive in the University’s archives.”\(^5\)

In 1997, SMU launched “The Campaign for SMU: A Time to Lead”, with a goal of $300 million. The campaign beat the initial goal by raising over $440 million. The campaign contributed

\(^{1}\) Ruth Patterson Maddox, *Building SMU* (United States of America- Odenwald Press, 1995), Pg 9
\(^{2}\) Building SMU, pg 15
\(^{3}\) Marshall Terry, *From High on the Hilltop* (DeGolyer Library, Southern Methodist University and Three Forks Press, 2009) pg.15
\(^{4}\) From the High on the Hilltop, pg 29
to all aspects of the campus, including new construction and major renovations. All of the funds and buildings were in one way or another related to goals and objectives of the strategic plan of the University. As the main campus began to grow, in 1998 Electronic Data Systems Corporation donated buildings on what would become a new campus for SMU, known as SMU-in-Legacy, in Plano, Texas. The campus was renamed in 2009 as SMU-in-Plano. SMU also has a campus in Taos, New Mexico, known as SMU-in-Taos, which has been traditionally used for summer programs offered to SMU students.

By September of 2008, SMU launched the largest fund raising campaign in the history of the campus: SMU Unbridled: The Second Century Campaign. The goal of the campaign was to raise $750 million to bring the University to a new level of excellence in the areas of student scholarships, faculty and academic endowments, and support for the campus experience. At the conclusion of the campaign, over $1.15 Billion in commitments was received making it the largest campaign receipts in the history Texas private colleges and universities. The campaign's public phase was scheduled to last five years, and coincided with the centennial of the University's founding in 1911 and opening in 1915.

**Campus Character and Overall Design**

**The Mission of Southern Methodist University**

Southern Methodist University will create, expand, and impart knowledge through teaching, research, and service, while shaping individuals to contribute to their communities and excel in their professions in an emerging global society. Among its faculty, students, and staff, the University will cultivate principled thought, develop intellectual skills, and promote an environment emphasizing individual dignity and worth. SMU affirms its historical commitment to academic freedom and open inquiry, to moral and ethical values, and to its United Methodist heritage.

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5 From High on the Hilltop, Pg 74  
6 From High on the Hilltop, pg 63  
7 Southern Methodist University, [http://www.smu.edu/AboutSMU/Mission](http://www.smu.edu/AboutSMU/Mission), (5/16/2016)
Executive Summary

SMU is committed to the continued improvement of its programs to serve outstanding students and to rise among leading educational institutions in the United States. Building on its current strengths, SMU will continue to respond to the evolving needs of its constituencies within the Metroplex and beyond, with an impact that transcends borders in our global society. As shown by the success of The Campaign for SMU: A Time to Lead and SMU Unbridled: The Second Century Campaign, the University’s constituent groups are strongly committed to providing the financial and personal support needed for SMU to achieve its goals.

SMU has at its core the liberal arts and sciences surrounded by a constellation of professional schools. The fundamental focus of Launching SMU’s Second Century is enhancement of the quality of the University’s faculty, students, and academic programs. To support the six goals of Launching SMU’s Second Century, SMU must:

• Enhance all major components of academic quality to strengthen SMU’s stature in the higher education community.
• Build upon the tradition of inspired teaching as it promotes engaged and interdisciplinary learning.
• Strengthen capabilities to conduct research and promote creative achievement.
• Enhance the quality of life for students and their social and moral development, citizenship, and leadership as potential world changers.
• Broaden global perspectives in the University’s academic and student life programs.
• Provide effective financial stewardship.

The University seeks to achieve its goals within a challenging, diverse environment characterized by increased competition for outstanding faculty, staff, and students. Progress toward SMU’s goals will require the judicious use of existing human and financial resources through faculty and staff development programs, more efficient administrative procedures, improved student retention, and careful review of financial models. Full achievement of these goals, however, will be possible only with the continued commitment and support of the University’s alumni and friends. Working together, we can achieve our goal of growth in national and international distinction, building upon SMU’s heritage.  

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8 http://www.smu.edu/~media/Site/AboutSMU/StrategicPlan/SMUStrategicPlanBooklet2016-2025. (5/20/2016)
SMU is a private university dedicated to educating students to have an impact on their professions and communities and the world. Students benefit from small classes, research opportunities and leadership development. The University is strengthened by its partnership with the Dallas region, a global center of commerce and culture. SMU students, faculty and alumni are changing the world through their chosen fields, civic engagement and service to society.

General Profile

- SMU is a private university offering undergraduate, graduate and professional programs through seven schools.
- SMU is celebrating the centennial of its founding in 1911 and its opening in 1915. The University was founded by what is now The United Methodist Church, with support from Dallas leaders. SMU is nonsectarian in its teaching and committed to freedom of inquiry.
- SMU enrolls more than 11,000 students from all 50 states, the District of Columbia and nearly 100 foreign countries. Students represent diverse geographic, economic, ethnic and religious backgrounds.
- The University’s main campus, five miles north of downtown Dallas, comprises 101 buildings on 234 acres, including 15 acres with 19 buildings east of North Central Expressway. Other campuses are at SMU-in-Plano, with four buildings on 25 acres north of Dallas, and SMU-in-Taos, with 33 buildings on 423 acres in Northern New Mexico.
- SMU’s endowment is now $1.4 billion.
- SMU received a record $31 million in external funding during fiscal year 2013-14 for research in the sciences, engineering and education conducted throughout the U.S. and worldwide.
- The University's nine libraries house the largest private collection of research materials in the Southwest, with more than four million print and electronic volumes.9

Campus Master Plan

Refer to Appendix A-1A.

END OF SECTION

9 [http://www.smu.edu/AboutSMU/Facts](http://www.smu.edu/AboutSMU/Facts) (5/20/2016)
PART A-2

ADMINISTRATIVE AND PROCEDURAL

Introduction

Facilities Mission Statement

The Office of Facilities Planning and Management supports the University's mission through the planning, management, operation, and maintenance of efficient, functional, state-of-the-art, safe, environmentally sustainable, and inviting environments that foster educational instruction, learning, research, and service to the community.

The Office of Facilities Planning and Management is committed to the following:
- To plan, execute, and maintain the University's buildings and grounds to be aesthetically appropriate, operationally reliable, and functionally superior for their expected useful life.
- To provide timely, accurate, reliable, and fiscally responsible facilities services to the campus community.
- To recruit and retain a qualified and professional team dedicated to service, leadership, and excellence with a commitment to growth and development through continuous learning.
- To seek knowledge and understanding of current industry standards, strategies, and techniques for implementation, management, and maintenance of the University's facilities.

Project Communication Chart

The University has developed a project communication structure for the Design Team to follow as an aid to illustrate the desired flow of communication throughout the design and construction process. Design Teams are expected to adhere to this protocol. Refer to Appendix A-2A.

University Policies

Refer to Appendix A-2B.

Applicable Contracts

Determination of contract method shall be determined by Facilities. All design and construction agreements are subject to further modification prior to award of contract.
**Design Contracts**

Projects that are on a limited scope, time, and dollar amount shall use:
- One-time Consulting Services agreement as modified by SMU

Projects that are not on a limited scope, time, and dollar amount:
- AIA B102, as modified by SMU
- AIA B132, as modified by SMU

Purchasing for FF&E:
- Issues Purchase Orders only

Design Team Professional Liability Insurance:
- Refer to [www.smu.edu/BusinessFinance/riskmanagement](http://www.smu.edu/BusinessFinance/riskmanagement).

**Construction Contracts**

Lump Sum Bid Projects
- A101, as modified by SMU
- A201, as modified by SMU

Construction Manager at Risk
- AIA A133 CMc as modified by SMU
- AIA A201, as modified by SMU

One-Time Services Agreement Contract- small scope, usually one-month duration
- Used for miscellaneous work

Construction Insurance Requirements
- A201 as modified by SMU
- Refer to [www.smu.edu/BusinessFinance/riskmanagement](http://www.smu.edu/BusinessFinance/riskmanagement).
Invoicing Procedures

Design Contracts

The Design Team shall provide a cost breakdown of fee in accordance with Facilities “A/E Fee Proposal Worksheet”. The worksheet shall be submitted at the time of fee proposal, incorporated into the Owner/Architect Agreement, and used as a basis for future invoicing. Refer to Appendix A-2D for A/E Fee Proposal Worksheet. Billing breakdown and format must match the “Worksheet Content”. All Consultants shall provide supporting documentation information along with back-up copies of the original documents. Receipts shall be clear on what is being billed. Include project name, purpose, and who was in attendance with every receipt.

Payments are due and payable thirty (30) days from the Owner’s receipt of a complete and accurate invoice. Amounts unpaid sixty (60) days after Owner’s receipt shall bear interest at the rate entered in the agreement. Architect shall submit to Owner one (1) set of the invoice and all supporting documentation for services rendered and reimbursable expenses incurred through the last day of each month. Architect shall submit such invoices to Owner by the 15th of each month. Architect shall submit the two (2) sets of the invoice and all supporting documentation to: Financial Officer, Southern Methodist University, Facilities Planning and Management, P.O. Box 750510 Dallas, Texas 75275-0510.

Additional Services

For Additional Services of the Architect beyond the Scope of Basic Service, Architect will provide to Owner a written description of the Additional Services to be provided, inclusive of a fee proposal. If the basis of compensation for Additional Services is to be on an hourly rate basis Architect shall be compensated based on the Hourly Rate fee schedule provided in the Agreement. Architect shall only perform the Additional Services agreed to in writing by SMU and Architect. Payment of Additional Service will be upon performance and execution of a Change Order to increase the contract value.

Reimbursable Expenses

When reimbursable Expenses are in addition to the Architect’s compensation expenses will include items incurred by the Architect and Architect’s consultants in the interest of the Project for:

1. Owner-requested special documents and reproductions;
2. Owner-requested special postage and handling of documents, courier service, etc.;

3. Renderings and models requested in writing by the Owner.

4. Travel and living expenses for out-of-town travel beyond the Dallas/Ft. Worth area authorized in advance in writing by the Facilities Project Manager.

All costs for in-house plotting, printing, and progress printing for coordinating or design purposes shall be included in Architect’s Basic Services. Only printing and plotting associated with agreed submittals requested by SMU are subject to reimbursement.

Architect shall send review and final documents via electronic means to a reproduction firm as directed by Owner, and include any charges for time associated therewith in Architect’s Basic Services. If included in Design Team’s scope of services, preparation of as-built drawing CAD files shall be listed as a separate line item in the fee proposal. As-built drawings shall be received in both electronic and hard formats.

Reimbursable expenses and any other items included as Reimbursable Expenses (travel, materials/services), shall be reimbursed at a multiple of one point one (1.1) times the expenses incurred by the Architect and consultants in the interest of the Project.

Tax ID Certificate

Available upon request. Contact Facilities Project Manager.

Construction Contract Progress Payments

The Design Team’s expectations and responsibilities with regards to review and processing of contractor’s Applications for Payment shall be in accordance with the Owner/Architect Agreement and the General Conditions.

1. Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum, inclusive of Change Orders executed in accordance with these Contract Documents, to the Contractor as provided below and elsewhere in the Contract Documents.

2. The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

3. Provided that two (2) original sets of a complete and accurate Application for Payment is received by the Architect, on Form G702 and G703, and one (1) set of all applicable and related Schedules, supporting documentation, and applicable executed and notarized Owner provided Lien Waivers, in accordance with these Contract Documents, on or
before the last day of each month (unless such date falls on a weekend or holiday, then on the previous business day); and, provided Owner receives from Architect by the seventh (7th) day of each month (unless such date falls on a weekend or holiday, then on the previous business day) a Certificate for Payment for such amount as Architect determines is properly due. Owner shall make payment to the Contractor on the last day of the month (unless such date falls on a weekend or holiday, then on the next business day). If a complete and accurate Application for Payment is received by the Architect after the last day of a month, payment shall be made by the Owner per contract terms.

4. Each Application for Payment shall be based on the most recent schedule of values, on Form G703, submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

5. Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

6. Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of Ten Percent (10%).

- Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of Ten Percent (10%);

- Subtract the aggregate of previous payments made by the Owner; and

- Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment.

7. The progress payment amount determined shall be further modified under the following circumstances:

- Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to ninety percent (90%) of the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
• (Section 9.8.5 of AIA Document A201-1997 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

• Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201-1997.

8. Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment, which have not been delivered and stored at the site.

**Project Construction Delivery Method**

The project construction delivery method on all SMU projects will be determined by Facilities. Projects are awarded through a competitive qualification process. The final selection and contract method is approved by SMU with recommendations by Facilities. Methods will vary based on the project’s size, scope, and complexity. When a Construction Management at Risk (CMAR) method is used, Facilities reserves the right to perform a construction audit.

**Facilities Standard Division 00 Documents**

Division 00 documents will be edited by Facilities and coordinated with the Design Team.

Refer to Appendix A-2E for sample Division 00 Documents.

**Facilities Standard Division 01 Specifications**

Division 01 Specifications are subject to review and revision, based on and as required to suit specific project requirements. Facilities will provide the Design Team with live (editable) electronic files of the most current versions. The Design Team will be responsible for editing the specifications for each project, for coordinating Division 01 specifications with Division 00 documents, and for signing and sealing written construction documents in accordance with State architectural licensing laws. Proposed additions, deletions, and other edits made by the Design Team must be reviewed and approved by the Facilities Project Manager prior to incorporation into Bidding or Construction Documents.

Refer to Appendix A-2F for sample Division 01 Specification sections.
**Commissioning Process**

The request for commissioners will be determined by Facilities. The degree of commissioning shall be based on the size, scope, complexity of the project, and whether the project will seek LEED certification. The Commissioning Agent shall be engaged by Facilities, and contracted directly by the owner early in the design phase. The Design Team is required to incorporate the commissioning agent’s requirements into the project Specifications.

Refer to Section 01810 for detailed description of commissioning requirements.

**Closeout Procedures**

Refer to Appendix A-2G for Closeout Worksheet.

END OF SECTION
PART B-1

PROJECT PLANNING / PROGRAMMING / DESIGN

General Design Requirements

The Southern Methodist University campus is nationally recognized for its beauty and character. The design of new facilities, additions to existing facilities, and significant renovations present the opportunity to enhance the campus. These facilities shall be designed to balance functionalism, sustainability, aesthetics, serviceability, initial cost, and operational cost. Recognizing the history of the campus, building materials and systems shall be selected for maximum longevity with minimum maintenance.

Campus Review and Approval Process

Project Time Line

Southern Methodist University has developed a system for the funding of new construction and renovation projects. Once funding has been obtained, the University will select the site. The Design Team will be selected through a competitive qualification and fee proposal process. After the project is awarded to the Design Team, there will be a series of reviews and meetings to discuss the existing conditions of the proposed site before the design process starts. Topics may include (as applicable): Existing utility locations, available services to the site, lack of needed services, impact of building design based on the utilities, etc.

Along with the preliminary review, there will be SMU and Design Team reviews throughout the entire design process of the project. Refer to Appendix B-1A, which outlines the chain of events that will happen over the course of a project.

- Identify Building Type
- Utility review
- LEED selection and checklist review
- Schematic design review at 100% (Commission agent shall review for enhanced commissioning)
- Code Review
- Design Development review at 100% (Commission agent shall review for basic commissioning)
- Room Numbering - Refer to Appendix B-6A.
- Construction Documents review at 50% & 95%
Site Analysis Process

General

At the onset of the design process, the Design Team shall participate in a Preliminary Utility Review Meeting with SMU, to ascertain, at a minimum, the following:

- Interference from existing utilities
- Presence and condition of available services
- Lack of needed services
- What services would be best to serve the facility

The Design Team shall specifically identify to SMU whether existing utilities will impact building size, location, footprint, orientation, etc., or whether utilities must be relocated to accommodate proposed new construction.

Owner-Furnished Information

Southern Methodist University will provide the Geotechnical and Topographical reports, utility maps, campus plans, and any other pertinent documents in hard copy of electronic format, which may be available in the University’s archives.

Considerations

The Design Team shall consider the following preliminary design checklist before beginning the designing process.

- Site Utilization
- Utilities
- Services
  - Deliveries
  - Trash / recycling
  - Catering
  - Pedestrian access
    - Including primary accessible route
  - Vehicular access
    - Including primary accessible route
    - Including emergency vehicles
- Orientation of building
- Interface with landscape, hardscape, lighting
- LEED requirement (Refer to Part B-2 for LEED requirements)
- Building footprint
- Foundation Type
- Site location-
  - Flood plain analysis
- Required Permits
  - Building
  - Groundwater discharge permit

**Project Planning and Programming**

**General**

Programming will be user-specific, based on campus location, building type, end-user’s needs, and requirements.

**Participants**

Will generally include the Oversight Committee, User Group, Facilities Project Manager, and other Facilities specialist(s), as deemed necessary. As needed, the University may retain an external space planning consultant to assist the end users in programming requirements.

**Identification of Building Type and Usage**

- This will be determined by the University and further defined during the programming stage through participation of the User Group.
- Lab, classroom, residential, athletic, performing arts, parking garage, staff/faculty office, research, etc.

**Communication**

The Design Team shall channel all communications through the designated Facilities Project Manager. Southern Methodist University project communication flow chart can be found in Appendix A-2A.

**Preliminary Review of Utilities and Services**

The Design Team is responsible for providing adequate space to accommodate the proposed building’s utilities and services and coordinating final location of such with SMU.
**Design Process**

The Design Team is expected to provide its expertise and experience in guiding the future building users in developing and validating the building program. In certain cases the University may retain an external Space Planner.

The Design Team is expected to consider the requirements and proportions inherent in Collegiate Georgian Architecture, (i.e. window size and spacing, structural bay size and spacing, etc). (Note: This is on the Main campus only; may not apply at Plano, East Campus, or Taos)

In addition, the Design Team will also be responsible for providing adequate space to accommodate the building’s utilities and services. Coordination of mechanical space, electrical spaces, custodial spaces, as well an information technology spaces must be accommodated and coordinated with the University in order to provide sufficient square footage. Mechanical and electrical spaces shall be designed to permit removal of major equipment intact. These spaces shall be designed to permit full and unobstructed access to all equipment. Particular care shall be taken to ensure main electrical service equipment can be replaced due to failure, considering the potential loss of facility power. Wet Mechanical Rooms shall be located on the lowest floor (basement preferred). Air Handling Unit Mechanical Room shall be located on the highest floor (attic preferred).

From building-user interviews and work sessions, the Design Team will develop a series of bubble diagrams, adjacency diagrams, blocking diagrams, stacking diagrams, as well as any other visuals, in order to convey its understanding of the building program to the User Group.

- Engage End-Users in development of room sizes, layouts, and configurations; Design Team to bring its expertise for user’s consideration.
- Design Team to differentiate between user’s “needs” and “wants”
- Design Team to consider utilization rates. (Calculate and enter on Appendix B-2D, page 10.)
- Work with recommendations of space planner’s study, if applicable.

**Basic Service Deliverables**

As defined in the Owner-Architect Agreement, but shall generally include the following:

- Schematic Design Phase
  - Drawings
  - Preliminary project description (PPD), narrative, or outline specifications;
  - Opinion of probable cost, which may be prepared in conjunction with a 3rd party cost estimating consultant or the Construction Manager for the project.
• Design Development Phase
  o Drawings
  o Outline specifications
  o Estimate of probable cost, which may be prepared in conjunction with a 3rd party cost estimating consultant or the Construction Manager for the project.

• Construction Documents Phase
  o Drawings
  o Project Manual including specifications and information for Guaranteed Maximum Price (GMP) pricing/bidding
  o Estimate of probable cost, which may be prepared in conjunction with a 3rd party cost estimating consultant or the Construction Manager for the project.

• Bidding and Negotiation Phase
  o Answer all Requests for Information (RFI)
  o Review all Substitution Requests
  o Addenda, including all necessary attachments (drawings and specifications).
  o Review of bids with Facilities.

• Construction Contract Administration Phase
  o Site visits, including written field reports.
  o Additional site visits as necessary to resolve conflicts.
  o Responses to RFI's.
  o Submittal review and approval.
  o Issuance of ASI's.
  o Issuance of Proposal Requests, or RFPs.
  o Review of contractor’s proposals or change order requests.
  o Processing of Change Orders.
  o Review and approval of contractor’s pay applications
  o Attendance at O-A-C meetings.
  o Attendance at Pre-Installation Conferences.
  o Participation in Substantial Completion and Final Completion inspections, including supplementing contractor’s Punch Lists.
**Campus Locations & Building Codes**

As stated in Part A, Southern Methodist University consists of four campuses, each of which is located in a separate jurisdiction, as follows:

- **Main Campus:** City of University Park, TX
- **East Campus:** City of Dallas, TX
- **SMU-in-Plano Campus:** City of Plano, TX
- **SMU-in-Taos Campus:** County of Taos, NM

In addition to the governing building codes in effect by the respective municipality in which the Campuses are located, each project shall be designed in accordance with additional prevailing codes adopted by the associated jurisdictions, including, but not limited to, the following:

- ANSI/ASME A17.1 – Elevator Code
- International Fire Code
- International Plumbing Code
- National Electric Code (NEC)
- International Electric Code (IEC)
- Texas Accessibility Standards (Texas projects only)
- Americans with Disabilities Act (All Campuses)
- All applicable building code amendments
- Energy Code
- Mechanical Code
- Building Code
- Existing Building Code (for remodels)

Applicable building codes are to be considered as minimum requirements. The Architect and consultants shall consider life-cycle costs, utility costs, and adaptability/flexibility should the building use change over its lifetime. The potential horizontal or vertical expansion should also be discussed with the University. The University's Risk Management Department may provide design input that supersedes code minimums, but in no way shall be less than the minimum requirement of the applicable codes.

**Accessibility Requirements**

**Accessibility Standards**

Southern Methodist University strongly enforces designing under the Texas Accessibility Standards (TAS) for all projects located in the State of Texas as well as the current version of the Americans with Disabilities Act (ADA).

**Accessibility Reviews and Inspection**
The Design Team shall have a preliminary accessibility plan review that will be conducted no later than the 50% completion of the Construction Documents. All plan reviews shall comply with Texas Department of Licensing and Regulation (TDLR) - for projects in Texas only.

All projects in Texas will be required to comply with the requirements of the Texas Accessibility Standards. The Architect will be required to use the Registered Accessibility Specialist (RAS) selected by SMU. The Architect shall be work with SMU to coordinate the RAS review. Contact with RAS must be made before the date of Substantial Completion. The review must happen within 30 days of initial contact with the RAS. Upon the completed inspection, the RAS will submit its inspection report to: SMU, the Contractor, and Architect. SMU shall submit plans for review, as well as requests for inspections for all small internal projects.

**Signage**

Refer to Part B-6 - Graphics, Signage, and Wayfinding.

**Targeted Accessibility Issues**

The Design Team shall pay particular attention to the following sections, but does not preclude the Design Team from applying all sections of these documents as required.

**Texas Accessibility Standard**

4.1.2* Accessible Sites & Exterior Facilities: New Construction

4.1.3* Accessible Buildings: New Construction

4.7* Curb Ramps

4.8* Ramps

**Americans with Disabilities Act**

4.3* Accessible Route

4.6* Parking and Passenger Loading Zones

4.7* Curb ramps

4.8* Ramps

*Code provision reference numbers are subject to change.
Drawing Conventions and Formats

Construction Document Set

The construction document format shall be as follows:

- Title block to be located in the right-hand margin oriented vertically.
- Sheet numbers in the lower right hand corner.
- Name and physical address of the project must be clearly identified.
  (Name of project to be determined by the University, and shall be consistently utilized on all drawings, specifications, correspondence, and submissions to authorities having jurisdiction.)
- Consultants will deliver an electronic version of all documents and drawings for the 100% Construction Documents submission.
- Cover Sheet containing complete index of drawings for all disciplines and contact details for Facilities Project Manager and Consultants.
- Drawing legends included within each discipline shall be located at the front of that discipline’s section in the Construction Documents.
- Live AutoCAD files having x-references bound into the file to be provided by the Design Team. Layering system used by the design team must be descriptive and intuitive. In addition, design team must provide a legend of layer names used in the project. Alternatively, the Design Team may use the layering system referenced in Appendix B-1B.
- Consultants will deliver an electronic version of all documents and drawings at the 100% Construction Document Set.

Project Record Documents

Project Record Documents shall be provided to the University upon completion of construction. Unless otherwise identified in the applicable Division 01 Specification Section, Project Record Documents shall include the following:

- Record Drawings - From Contractor.
- As-Built drawings - From Architect.
- Record Specifications – From Contractor.
- Record Submittals - Equipment submittals shall have arrows denoting supplied equipment.
- Project Record Documents shall be provided to Southern Methodist University upon (Substantial/ Final Completion).
• Hard Copies of red-lined Construction Documents to be provided from contractor.

• Converted files to PDF format to be provided by Design Team.

• Live AutoCAD files having x-references bound into the file to be provided by the Design Team. Layering system used by the design team must be descriptive and intuitive. In addition, design team must provide a legend of layer names used in the project. Alternatively, the Design Team may use the layering system reference in Appendix B-1B.

**Specification Conventions and Formats**

**Format**

Project Manuals and Specifications shall be prepared and organized in accordance with principles and practices as set forth by the Construction Specifications Institute (CSI) *Project Resource Manual*, including, but not limited to, the following:

- CSI *SectionFormat* (2008 edition, as is currently in place by the Design Team.)
- CSI *MasterFormat* (2004 edition, as is currently in place by the Design Team.)
- 2004 Edition: Divisions 00 through 33
- All specifications for any given project shall be prepared and organized under the same version. Multiple versions within the same Project Manual will not be permitted. Organization of specifications by older versions will not be permitted.

**Content**

Project Manuals issued for construction shall contain, at a minimum, the following information:

- Cover sheet and issue date, identifying project, SMU, and design consultants comprising the Design Team.
- Table of Contents.
- Professional Seals Page(s), identifying which specifications were prepared by which consultant, and its respective professional licensure seal, signature and date (unless otherwise mandated by the state licensure board in the state where the project is located).
- Division 00 – Bidding and Contracting Requirements (prepared by Facilities). Refer to Appendix A-2E for University Standard Division 00 Documents.
• Division 01 – General Requirements Specifications (prepared by Design Team from Facilities masters, in coordination with Facilities). Refer to Appendix A-2F for University standard Division 01 Specifications.

• Division 02 through 16 / 33 specification sections.

• All specifications must be in the project manual and not on the drawings.

• Applicable section, page number, project name, etc, identified on the header and footer of each page.

END OF SECTION
PART B-2

SUSTAINABLE DESIGN/ GREEN BUILDING APPROACH

Introduction

Southern Methodist University has been participating in the Leadership in Energy Environmental Design (LEED) building rating system since the Embrey Building was constructed in 2006. Since then, the University has adopted LEED as a guiding principle in all major construction and renovation projects. Through this program, the University strives, as the U.S. Green Building Council (USGBC) Reference Guide states, to balance environmental responsibility, resource efficiency, occupant comfort and well-being, and community sensitivity.

The purpose of this Section is to give the Design Team guidance in achieving sustainable targets and implementing LEED as well as to articulate the University’s specific priorities and preferred strategies to reach certification.

This Section is not intended to summarize the USGBC LEED reference guide or checklist but rather to specifically summarize the goals of the University as it specially applies to implementation of LEED.

Approach and Philosophy

All projects (new construction and renovations) will be registered with the USGBC by Facilities. Registration will be conducted during the fundraising phase. It is the University’s goal to make a minimum benchmark of “LEED Silver” for every new construction project on each campus. With every design, a sustainable design standard has been developed and will be applied to every new project (Refer to LEED Requirements, page B-2-2).

Prior to project award, the Design Team will be required to present and demonstrate to the University its initiative and knowledge of sustainable design. The initial Request for Proposal Kick-Off Meeting requires all design professionals involved in the LEED design be present. Each team should present documentation of each design member’s Integrated Design Process experience used on previous projects. Creativity in sustainable design is highly recommended. The Design Team is encouraged to include in its fee proposal any additional LEED costs as a separate line item. The Design Team shall also provide a detailed breakdown of the LEED credits and how they are being incorporated into the design.

As stated in the previous Section, periodic design reviews will be conducted with the Design Team and the University. The LEED meetings will be conducted during the design and construction phases on a monthly basis at a minimum. The Design and Construction Team is responsible for documenting all prerequisites and credits achieved during the design and construction phases.
Each campus will have different requirements for achieving LEED credits. The Design Team is responsible for identifying the most recent City sustainable requirements prior to starting design on the project.

**Main Campus- Dallas, TX**

The main campus of Southern Methodist University has applied the Collegiate Georgian Architectural Style to their campus, which limits its ability to apply all LEED credits to its projects. The University guidelines shall be applied to this campus.

**East Campus- Dallas, TX**

The location of the East Campus falls under the jurisdiction of the City of Dallas. On April 9, 2008, Dallas adopted the “Green Building Program,” and on September 26, 2012 adopted the International Green Construction Code (IGCC) with amendments. Refer to Ordinance #081070 for specific information. The City regulations along with the campus requirements for the East Campus shall apply to all projects on this campus.

**SMU- in- Plano Campus- Plano, TX**

The SMU-in-Plano Campus is in the City of Plano. On January 8, 2007, the City of Plano adopted a City LEED policy in order to demonstrate the City’s commitment to sustainability. The Plano Campus shall adhere to Plano’s requirements, as well as the University’s requirements.

**LEED Requirements**

The University has developed a series of individual guidelines for campus sustainable design for each SMU campus. Each campus has limitations on certain LEED credits that can be achieved based on existing conditions.

*Minimum Requirements are strongly recommended*

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Refer to Appendix B-2A for LEED Checklist

In addition to the LEED checklists, the following documents are guidelines that Facilities request the Design Team follow.

- Refer to Appendix B-2B for DGS Basis of Design (BOD) for Small Buildings.
- Refer to Appendix B-2C for Special Conditions, Inclusions, and Exclusions.
• Refer to Appendix B-2D for Owner’s Project Requirements Document for LEED Fundamental Commissioning.

• Refer to Appendix B-2E for Waste Management Plan.

• Refer to Appendix B-2F for Indoor Air Quality Management Plan for New Construction.

• Refer to Appendix B-2G for Indoor Air Quality Management Plan for Renovations

END OF SECTION
PART B-3

SITE PLANNING AND UTILIZATION

Civil Design Considerations

Topography and Geotechnical

Site surveys and subsurface geotechnical reports will be furnished to the Design Team by Facilities.

Hydrology and Drainage

After the Design Team obtains the topography and geotechnical reports from the University, a rough analysis will be conducted, to specifically look at the potential storm water runoff path, as well as the impact the water will have on adjacent buildings and sites. The Taos campus will require a flood plain analysis to be performed.

The current main campus drainage flow is as follows: Southwest corners of the campus drain to the University Park drainage system, and southeast corners of the campus drain to the City of Dallas storm water drainage system.

Vehicular Access

Deliveries

The Design Team shall take into consideration the various types of deliveries made to buildings on the SMU campus.

- Types of deliveries:
  - Deliveries of furniture/equipment, supplies
  - Catering/food service,
  - Mail/UPS/FedEx.
  - Laboratory equipment and gases

- Parking spaces for these different delivery types will need to be located in close proximity to an exterior door with a ramp. Parking spaces will need to be easily accessible from the major thoroughfare in order to accommodate for short-term parking. Temporary parking in fire lanes is unacceptable by the University.
Parking

Automobiles: Parking is to be coordinated with the Facilities Project Manager in conjunction with SMU's master parking plan. Accessible parking spaces are to be provided as needed or dictated. Student, Faculty, and parking staff is by a zoned system and by permit only. Any visitor to the campus can park in any metered parking space. Metered spaces can be found scattered throughout the campus as well in metered lots designated by signs. The intent of the parking layout is to keep all vehicular traffic to the perimeter of the campus, creating and encouraging a more pedestrian-friendly environment. The East campus has integrated parking. The Plano campus is comprised of surface parking.

Bicycles: Bicycles shall be parked in bicycle racks located adjacent to building entrances. Bicycle rack locations shall be reviewed and coordinated with Facilities. Refer to Part B-3 for campus-standard bicycle rack.

Motorcycles: Motorcycles shall be parked in regular automobile spaces.

Fire Department Access

University Park Fire Access: Refer to Appendix B-3B.

All other jurisdictions abide by city fire code for that area.

Waste Removal

Construction Waste

Refer to Part B-2 and B-4.

Dumpster Plan

Refer to Appendix B-3C.

Occupant Waste

Refer to Appendix B-3C.

Main Campus

SMU has designated waste collection sites located in selected places around the campus. In the event new waste collection sites are incorporated into a construction or renovation project, Design Teams shall locate and orient waste collection areas to
accommodate the types of dumpsters currently traversing the Campus. SMU dumpsters (for recyclables) are rear loading; City dumpsters (for wet trash / garbage) are driver side loading. The Design Team is responsible for coordinating with Facilities to ensure dumpster locations proposed for the intended project are located and oriented to properly facilitate waste collection.

The University has elected a trash separation system. Black bags are intended for wet trash (garbage), and are disposed of in the municipal trash dumpsters. Clear bags are intended for recycled materials and shall be placed in the SMU bins or brick enclosures. Custodial staff hired by the University regularly transports both black bags and clear bags from the buildings to their designated waste collection areas.

**East Campus & Plano Campus**

Both the East and Plano campuses have city dumpsters located in designated locations on the campus. The trash separation system used on the Main Campus is utilized at these satellite locations, as well.

**Utilities and Infrastructure**

The Design Team is responsible for coordinating with Facilities any drawings that contain the locations of any existing infrastructure located on or around the site. Once all information is compiled, the Design Team is responsible for performing an analysis of new utility lines that will be required and proposed locations of installation and connection. Questions to be asked: What lines are being connected, and how are they being connected? Do existing lines or utilities have sufficient capacity?

The following information is in reference to the main campus. The information on these topics for the Plano and East Campuses shall be coordinated with Facilities Project Manager.

**Fire Hydrants**

Design Team to include in documents as follows:

- Main Campus: City of University Park standard.
- East Campus: City of Dallas standard.
- Plano Campus: City of Plano standard

**Water**

The water supply for main campus buildings is supplied through the SMU internal water distribution system.
Sanitary

The new sanitary line shall be connected to the closest sanitary line to the selected site. This information is provided by the Facilities. Connection to the existing sanitary line shall only occur in one location. Connection types shall be in accordance with the City of University Park for the main campus, City of Dallas for the East Campus, and City of Plano for the Plano Campus.

Storm Water

The Design Team shall take into account the annual rainfall and storm water drainage created by the site. The Design Team shall also connect the building’s storm water drainage system to the underground drainage system to help minimize the amount of surface runoff.

Gas

The Design Team shall avoid providing natural gas in buildings for heating purposes. This is a safety measure that the University has recognized and established. However, natural gas will be considered in cases where natural gas service is being furnished for educational purposes.

Electricity

For all campuses, the SMU system has its own internal electrical system. SMU prefers that all new electrical equipment and transformers shall be located in below-grade vaults.

Telecommunications

Refer to Appendix B-3D.

Information Technology

Refer to Part B-5.

SMU encourages the consideration of the most energy efficient methods to provide heating and cooling. Among the options for consideration are heat pumps, heat recovery chillers, solar, electricity, chilled water, etc. Among the factors to be considered in evaluating the above options are life cycle cost, sustainability, maintenance requirements, reliability, projected life span, etc.

Underground Utility Tunnels

The SMU main campus utilizes subterranean tunnels for distribution of utilities throughout campus. If there is a need to provide a new tunnel, the new tunnel, as well as the intersection point of the existing tunnel, shall be waterproofed. The waterproofing system and material selected will be done on a case by case basis, depending on the circumstances of the specific tunnels’ location, depth, etc. Condensate return lines and certain designated pipes will be stainless steel. Chilled water and steam lines shall have welded connections. Tunnel shall provide drainage down one side. Direct
buried utility lines are acceptable alternatives to tunnel distribution. Direct buried lines shall be pre-insulated construction. Bulk insulation, e.g. Gilsulate, is acceptable with owner’s approval only.

**Vehicular, Pedestrian, and Bicycle Paths**

**Roads**

University-owned roads on the SMU main campus are constructed of material accepted by local jurisdiction. Materials shall follow the University Park standards. Refer to Appendix B-3A for Main and East Campus owned roads.

**Fire Lanes**

Fire lanes, that are not concrete curbs, shall be constructed out of concrete pavers that are marked “FIRE LANE.” Alternative products such as “grasscrete” may also be used.

**Sidewalks**

Pedestrians, bicycles, and golf carts shall share the same paths on the SMU campus. Sidewalks are required to be a minimum of 5’-0” in width. A radius at all corners is mandatory in order to accommodate campus golf carts.

Sidewalks are to be constructed of concrete and/or pavers. Concrete shall comply with University Park standards, and the pavers shall be selected by the Design Team and reviewed and approved by Facilities. Requirements for the East Campus and the Plano Campus shall be coordinated with Facilities. Irrigation sleeves shall be placed under sidewalks. Sleeve locations shall be coordinated with Facilities.

Curbs shall be constructed of concrete; mountable curbs will be located by Facilities.

All of the above shall be in accordance with SMU’s Landscape Master Plan.

NOTE: Facilities & designated SMU specialists to determine which provisions pertain to general campus maintenance, versus those required to be specified by the Design Team and performed by the Contractor.

**Trees, Shrubs, and Groundcover**

**Tree Care References and Reference Standards**

This landscape section relies heavily on reference to established practices and procedures of the consensus of the industry, those primarily being the International Society of Arboriculture (ISA), American National Standards Institute (ANSI), and Tree Care Industry Association (TCIA), and others.
ANSI Documents*

To fully utilize the Tree Care section, one must also obtain the current revision of the following documents and the current revision of its companion Best Management Practices (BMP) document:

- ANSI A300 (Part 1)-2001 Pruning
- ANSI A300 (Part 2)-2004 Fertilization
- ANSI A300 (Part 3)-2006 Supplemental Support Systems
- ANSI A300 (Part 4)-2002 Lightning Protection Systems
- ANSI A300 (Part 5)-2005 Management of Trees and Shrubs During Site Planning, Site Development, and Construction
- ANSI A300 (Part 6)-2005 Transplanting
- ANSI A300 (Part 7)-2006 Integrated Vegetation Management
- ANSI Z133.1 - American National Standard for Arboricultural Operations-Safety Requirements

*These publications are available, for a fee, at:
- ANSI http://ansi.org/
- ISA http://isa-arbor.com/
- TCIA http://tcia.org/

Site Planning, Site Development, and Construction

The phases of site planning, site development, and construction are the most crucial to the trees. Established trees are conserved during these phases. Considerations must be made and weighed with a variety of reasons, including economic, social, environmental, and cultural factors. SMU prefers to retain existing trees or accommodate them in ways which may include architectural changes and/or transplantation to make best use of their resources.

Management of Trees and Shrubs During Planning, Development and Construction

Objectives

Conserve the selected existing trees and shrubs on and adjacent to the construction site during the site planning, construction, and post-construction maintenance establishment phases of development.

Requirements

Landscape Architect:

Verifies compliance with applicable ordinances, rules, regulations and standards.

SMU Office of Facilities Planning and Management:
- Provides direction for development of management plan and specifications
- In conjunction with the Landscape Architect, verifies compliance with applicable ordinances, rules, regulations and standards

Arborist (retained by SMU): A qualified ISA-Certified Arborist shall oversee and consult during all phases:
- Help interpret guidelines and regulations to insure conformity to standards
- Act as a quality and consistency gate
- Document these activities

The arborist shall be trained in current practices and, if possible, have experience in the practice of all arboriculture tasks required by the project (i.e. large transplants, transplanting removals, integration and pests).

Additional personnel as needed.

Planning Phase

A site survey shall be made available and include tree resource evaluation, including current tree inventory data:
- Existing tree identification and location
- Condition and Hazard management evaluation
- Soil examination (if indicated by tree health)
- Work history
- Longevity and life stage of tree
- Utility of tree specimen and species in project outcome
- Special designations (i.e. dedications, special usage and placards)

Tree Resource Evaluation Scope

An arborist shall complete and make available the tree resource evaluation for the project area, and surrounding area. It is important to include the surrounding area due to the extensive nature of trees and the sensitivity of some trees to disruption. If a condition is observed requiring attention beyond that affecting the project scope, the condition must be documented and reported. Corrective action shall be determined and may directly impact and preclude further proceedings with all or parts of the project. Usually this is not the case, but some cases exist.

Suitability for Conservation

Suitability ratings could be assigned [See Annex A, ANSI A300 (Part 5)]
Suitability specifications vary depending upon the species of tree; soil condition; construction/demolition activity; etc. Verify and conform to any agency or resource preservation ordinances.

**Design Phase**

Tree protection specifications and goals for the project shall be communicated during the design phase. The conserved trees shall not be compromised where health will be impacted either by the design or by implementation of the project. An arborist working with SMU and the architect prior to developing final site plans shall conduct the selection of trees to remain on the site. The existing conserved trees health shall not be compromised either by the design or by implementation of the project. The following items will be addressed when conducting the tree selection:

**Tree Inventory**

Inventory shall be conducted while building project is in early planning stages.

**Tree Size**

Only trees over a minimum size (6” DBH) shall be inventoried for preservation or removal. Small trees (eg. 4-6” DBH) which are open grown and of suitable species and shape should be inventoried for future relocation on site. The largest trees on the site may not be the most desirable to preserve if they are over mature and/ or declining.

**Species**

Identify genus and species when possible. Some species are inherently tolerant of root damage. This may be related to rooting habits or to the trees' inherent capacity to withstand stress. Preservation of short- lived species and those which have inherent insect, disease or structural problems shall be avoided.

**Location**

Trees to be preserved shall allow for access to the site by equipment. As a general rule, trees should not be left within twelve feet of a structure and should be removed. A minimum distance of twelve inches for each inch of trunk diameter (the Critical Root Zone) should remain free of any construction activity around each tree. (Refer to Appendix B-3N) This includes cuts, fill, and infringement by equipment, materials storage, etc. Where this construction-free zone cannot be maintained, site plans shall be altered or and tree removal considered.
**Age and Condition**

Evaluate tree condition as Good, Fair, Poor, Dead/Dying or by ISA valuation formula percentage classes. There is a tendency to save the largest and oldest trees since these are most prominent and attractive to the property owner. However, mature, trees are much less adaptable to site changes occurring during construction. If adequate undisturbed space cannot be provided to these larger older trees, then establishing young, vigorously growing trees should be favored. In any case, choose only healthy trees that are not suppressed or show evidence of trunk decay, structural deficiencies, bark injuries, disease or insect damage.

**Exiting Trees to Conserve**

Responsibilities to and scheduling of tree care such as pruning, maintenance, and irrigation within the Tree Protection Zone shall be established at this part of the project.

**New Trees**

The species selection is to be determined by the Landscape Architect. The conceptual site plans shall be submitted to Facilities for review and final approval. The site plans will need to include plant type, placement, location, accurate drip line of existing or proposed tree, irrigation needs, height, wind patterns, and sidewalk placement.

**On-site Pre-Construction Preparation**

Implementation of recommendations shall be communicated and tracked by the arborist of the project.

**Building Site Preparation**

Define areas for roads, construction path, structures and utilities as well as tree preservation zones (TPZs, see below). Locate specific sites for storage of building supplies and fill soil, worker and equipment parking areas and washout areas for concrete trucks. These areas shall not interfere with tree preservation areas zones. The decision of which trees are to be removed or preserved is addressed in the Design Phase. Designated green space areas that will endure construction activity such as parking or being driven over by any typical construction equipment, trailered, or have materials stored on them, should be covered with coarse wood mulch (such as under composed wood chips) to a depth of 8 inches minimum. This depth should be continuously maintained and periodically refreshed (every 6 months, maximum) as the project progresses. Heavier equipment requires additional appropriate padding.

**Worker Education**

Pre-construction meetings shall be held to advise construction crews of tree preservation areas (TPZs) and procedures to avoid damage to remaining vegetation in these
areas. Refer to ANSI A300 (Part 5)-2005 Management of Trees and Shrubs During Site Planning, Site Development, and Construction. A system of fines should be developed and imposed on workers, including subcontractors, who damage plants through negligence failure to use reasonable care, resulting in damage or injury. Most damage, visible and invisible is irreversible.

**Pre-Construction Site Preparation (Site Clearing)**

Trees which will not be preserved should be removed from the site in a manner to avoid injury to remaining trees. Heavy equipment should not encroach on the root systems of high value plants. If necessary, trees should be removed manually with chain saws, and stumps should be ground out instead of using heavy equipment.

Fell trees away from preservation areas whenever possible. Mitigation such as temporary bracing, root trimming, trunk flare exposure, soil amendments, etc. is preferred to be implemented before construction, except where the existing condition may protect the tree. When trenching or modification of the root pad encroaches heavily onto established trees, a root pruning method should be employed where the roots are exposed and trimmed with proper pruning tools several inches to the side of the trench bordering the trunk of the affected tree. Tearing of roots is to be avoided. Supplemental irrigation shall start if needed. Any roots exposed by construction activity shall be pruned flush to the soil. Backfill root areas with good quality top soil as soon as possible (i.e. within the workday). If roots are not backfilled within this time, they shall be covered with organic material such as composted mulch to a depth of 4 inches which will reduce temperature and minimize water loss due to evaporation.

**Delineating Protection Areas**

Tree protection zone barrier(s) shall be installed prior to site work. Tree protection areas shall be delineated with chain-link fencing to prevent encroachment of equipment. Do not store materials or equipment within drip line. For forest trees, the protection zone should extend 0.4 feet from the trunk for every foot of height. These are preferred areas for the tree protection zones. The minimum distance from the trunk of the tree protection zone should never be less than twelve inches for every inch of trunk diameter. For old trees, declining trees and those sensitive to construction, a larger tree protection zone is required. Fences should be erected at a minimum distance from the tree of twelve inches for every inch of trunk diameter. Signs, in English and Spanish should be placed visible from all directions, along the fence to inform workers of the purpose of the boundary. Mulch should be applied to protection areas to help reduce moisture stress. Area should be restored to a safe work site if trees were removed:

- Stumps to be ‘ground’ or dug out
• Holes from manual or mechanical removal (such as tree spading) shall be back-filled

• Consideration shall be made to salvage wood created from removed trees.

Tree Protection Zone (TPZ)

Tree protection zones shall be established and maintained for all trees to be conserved on a construction site.

**Specification:** The Tree Protection Zone (TPZ) is part of the construction zone. A minimum TPZ is to be established at:

A. The drip line or horizontal extent of canopy

B. A diameter of 12 inches per diameter inch at breast height (DBH) measured at 4.5 feet from root flare whichever is greater.

This area may be adjusted for existing buildings, walkways, and roads by permission of SMU. Barricade shall be of 6 foot high chain link fence, either of panels or permanent installation with top rail and 2 inch diameter galvanized post in an enclosure. If panel construction is used, no gate is required. Barricade is suggested to *not* be screened as to allow inspection of TPZ and increased visibility for security. Signs, in English and Spanish should be placed visible from all directions, along the fence to inform workers of the purpose of the boundary. The barrier and proper signage shall be installed prior to any site preparation and shall be maintained throughout all phases of the construction project. Erosion and sediment control barriers shall be installed or maintained in a manner which does not result in soil buildup within tree drip line. Apply 4 inches of course mulch within protection areas to help reduce moisture stress and reduce maintenance.

**Exceptions:**

A. Where there is to be an approved grade change, impermeable paving surface, tree well, or other such site development, erect the fence 2 – 4 feet beyond the area to be disturbed.

B. Where permeable paving is to be installed within the tree’s drip line, erect the fence at the outer limits of the area to be paved, prior to grading so that the area is graded separately prior to paving installation to minimize root damage.

C. Where severe space constraints due to limits of construction location size or other special requirements, contact the campus arborist.
Where any of the above exceptions result in a fence being closer than 4 feet to a trunk, additionally protect the trunk with strapped on planking to a height of 8 feet (or the limits of lower branching) and install and maintain 8 inches of coarse mulch in addition to the reduced fencing provided.

**On-site Construction Phase**

The contracted arborist and the FS arborist when accompanied by the Facilities project manager or the Facilities Landscape Resource Manager, in coordination with Facilities project manager, shall be given access to and monitor implementation of recommendations. Tree health shall be monitored during the construction phase. Special care such as supplemental irrigation and bracing may need to be applied, and the party responsible should have been designated in the planning stage. In the event of damage to barriers and/or trees, corrective actions should be implemented.

**Excavations**

Where excavations are performed within the root zone of trees, trenching should be performed using a vibratory plow, directional borer or by air spading. Backhoes shall not be used to rip roots at considerable distances from the point of excavation.

**Monitoring**

An arborist should inspect the project site weekly or more often on large projects. The arborist should inspect fences, cuts and fills, as well as the general health and condition of the trees. Violations and tree problems should be reported to the project coordinator in writing, and followed up on until corrective actions are applied.

**Tree Maintenance During Construction**

Trees that were previously irrigated should be irrigated during construction. They should receive a minimum of one inch of water per week from the combination of rainfall and irrigation. This is equivalent to 375 gallons of water per 1000 square feet within the TPZ. Trees with root injuries should be irrigated during droughts, especially in summer. Root-pruned and root-damaged trees should receive a minimum of one inch of water per week from the combination of rainfall and irrigation. This is equivalent to 750 gallon of water per 1000 square feet within the root zone (preservation area) of the plant. TPZ

Deadwood branches, storm damaged limbs and low limbs that interfere with construction, should be pruned properly by a professional in accordance to SMU pruning guidelines, on an as-needed basis.

Trees also should be monitored for presence of damaging pests. Appropriate control procedures should be implemented on an as-needed basis by Facilities. Treatments such as fertilization and maintenance pruning generally should be deferred until construction is complete, while treatments such as bark-tracing of wounds may need more immediate attention. Borer treatments may be necessary in summer in stressed, infected trees.
Monitoring and treatment will be administered by Facilities to all trees that are in a construction site or under one year warranty.

**Grade Changes**

Grade changes should be avoided around trees whenever possible. Site development should utilize existing contours in order to preserve feature trees. If grade changes are unavoidable, then refer to ANSI A300 (Part 5)-2005 Management of Trees and Shrubs During Site Planning, Site Development, and Construction. When grade changes plan to exceed 6” above or below pre-construction level during construction or permanently, acceptance by SMU is required prior to implementing.

**Post-Construction Phase**

Landscape establishment may occur at any time but is usually performed after construction and during hardscape installation. Installation of irrigation should avoid concentrations of established roots. AirSpade™ should be employed for work in this area (within the drip line of established trees). Tree health should continue to be monitored throughout all phases. Construction originated damage usually is not immediately apparent. Tree conservation recommendations should be revised if the construction activity has significantly altered the tree health and maintenance needs. Protective devices such as fences and barricades may be removed but required the tree protection zone must still be observed. Long-term tree maintenance specifications should proceed.

Transplanting objectives shall be established prior to beginning operations. Tree transplanting care is similar to its smaller woody and vegetative plant counterparts. Some practices may be extended towards their counterparts but only within the specifications of the respective material. Exceptions shall be discussed with the respective arborist or horticulturist before operations.

**Irrigation Installation**

Irrigation routing should avoid concentrations of established roots. We prefer using trenchless methods such as the AirSpade™ or directional boring trenching while working inside the Critical Root Zone (within the drip line of established trees).

**Compaction**

Soil areas beneath roadways, paved areas, sidewalks and other features shall be compacted to specifications required. All other green space areas where turf, planting beds, and trees will reside should avoid compaction and at least restored to 80 to 85% of maximum dry density as determined by the Proctor test. [Reference: ASTM D698-91]
Plant Material and Site Inspection

Project arborist and horticulturist can reject receiving incoming plants for, but not limited to, poor quality stock, disease, insect infestation, poor growth habits, disproportioned root to stem and canopy ratios, poor branching structure, wrong species or cultivar, unhealthy root system or root system structure. Inspection for girdling roots is as stated in section Post-Construction Tree Maintenance entitled “Root Pruning”. An initial 10% sampling of the delivery will be inspected. If more than two are found to exceed the limits by this guideline, the entire delivery may be inspected. Results will be communicated to next higher management level as how to proceed. Refer to “Best Management Practices: Tree Planting”. Soil analysis and drainage considerations should be assessed at the stage. Percolation test should be administered. Water should drain at the rate of 1 inch per hour and be completely drained below base of root ball in 24 hours. Report any condition beyond the original scope of transplanting work to the appropriate person authorizing the work. Work may need to stop and not proceed until the situation is rectified, in some cases.

Give the project manager 24 hours’ notice prior to any plant delivery so that he can notify the Landscape Resource Manager. All plant material must be approved by SMU and the project landscape architect prior to being installed. A picture of the plants to be installed will not suffice.

Project arborist is to have access to and inspect incoming plant materials at earliest point, at delivery, before and after planting. The project arborist may issue adjustments to the installation at time of planting to insure proper handling and installation.

Tools and Equipment

Digging and pruning tools shall be sharp to cut without breaking, crushing, or tearing the intended target. Digging equipment shall be maintained to manufacturers’ recommendations to maintain safety and proper delivery with minimal damage. Lifting devices (e.g. cables, slings, chains) shall be inspected, certified rated, and used only within limits (see ANSI A300 (Part 6) Annex B). Devices showing wear or history of abuse shall be decommissioned (removed from usage and rendered unusable). Equipment and work practices that damage the plant beyond the scope of the work should be avoided. (e.g. handling of the tree which causes fracture of the root ball) Root pruning tools shall be sharp to cut without breaking, crushing, or tearing roots.

Certified lifting devices shall be used according to manufacturer’s instructions and specifications within established safety standards.

Timing

Consideration shall be given to when the transplanting occurs and healthiness the plant is in during what season state the plant is in at that season (phenology). Adjustments shall be made, accordingly, e.g. watering, shading, frost protection.
If possible orient trees and shrubs to their original compass orientation before placing them in the ground. Opportunity to mark trees before digging is highly valuable.

If available, trees should be marked as to original compass orientation. Opportunity to mark trees before digging is highly valuable.

Methods of Handling

Handling of trees intended for SMU projects should incorporate any and all of the handling methods listed below at the earliest point of the transplant process. Continue following throughout transportation chain, from off-site, through local storage (if required) to installation at project.

Lifting

Prior to lifting root balls, roots should be separated from the surrounding soil. The system used for lifting shall prevent damage to the root ball, trunk and crown. Spreader bars should be used to distribute forces away from the root ball and provide crown clearance.

Transporting

The system for transport shall minimize desiccation and other damage to crown, trunk, and root ball.

Storing Before Planting

Health and vigor of the materials shall be maintained during storage. Holding times should be minimized through planning and just-in-time methods. Trees held on site before planting for more than 36 hours shall be protected as soon as possible from drying out, frost or heat, and sun. They need to be watered to prevent and reduce stress.

Digging the Hole

Follow established industry standards including those outlined in ANSI A300 (Part 6)-2005 Transplanting and its corresponding BMP. (Refer to Appendix B-3N.)

The final depth of the planting hole is determined by the depth and firmness of the root ball and other characteristics of the site (e.g. grade, surround) and shall not exceed the depth of the root ball. The depth of the root ball shall be measured from the bottom of the trunk flare to the bottom of the root ball. The soil directly beneath the root ball should be undisturbed or prepared to prevent settling. Planting hole width should be a minimum of 1.5 times the diameter of the root ball. With the exception of tree spade and roundball methods, the sides of the planting hole should be scarified. Use of augers and equipment such as backhoes may be employed to remove the central volume of the hole but the soil at the sides
must not be compacted by their utilization and should be hand dug. The sides of the planting holes must be roughed up to break up the glazing of the soil when planting all trees.

The planting hole should be dug no deeper than the root ball when measured from the bottom of the root ball to the trunk flare. The hole should be excavated to no less than 2 feet radius larger than the root ball, preferably, a slope sided hole that is three times as wide (diameter) as the root ball diameter. If the hole is augured, it must be then scarified to create rough star-shaped wall, removing at least 2 inches additional soil. Installation of a 4 inch “view tube”, to a depth of 24” below the bottom of the root ball is preferable. It is not required for every tree but in a regular interval not less than 33% of the trees in a planting section (approximately one irrigation zone), more with respect to varied soil and grade conditions.

**Installation of Plant Material**

Prior to lifting root balls, roots should be separated from the surrounding soil. The system used for lifting shall prevent damage to the root ball, trunk and crown. Trees shall be lifted by the container or by supporting the bare root ball. Trees should be placed in the same compass orientation from which they originated. If not marked, certain growth observations may be made to identify this orientation. The bottom of the trunk flare shall be 0-2” above finished grade. If the plant was accepted with objectionable roots, they may be removed before planting only if they do not disturb the integrity of the root ball. Removing objectionable roots should then be done after planting by a qualified individual with appropriate tools and methods.

Once the tree is placed in planting hole, untreated burlap shall be cut away from the 1/3 of the root ball.

Balled and burlap (B&B) stock should have covering removed from top and down 1/3 the sides of the ball, 12 inches or more, whichever is greater. Remove completely when possible. Treated or synthetic burlap shall be removed completely.

Metal baskets shall be removed from top and down 1/3 the sides of the ball to a depth of 12 inches or more, whichever is greater. Remove completely when possible.

Remove all rope, tags, and tree wrap from trunk and limbs.

Boxed containers should have sides completely removed.

**Backfill and Watering**

Backfill should be same or similar to the soil at the planting site. Backfill soil may not be amended to change texture (i.e. adding sand and/or loam to our primarily clay soils). Chemical amendments at planting should only be applied if a soil analysis determines need to supplement to adjust for pH, micro-and/or macro-nutrients. In the first year nitrogen
should be withheld. Method should be a slow-release formulation and shall be integrated evenly in the first 12-18 inches.

The back-fill soil shall be installed and settled in layered sections, with the use of water, to limit future settling and eliminate or prevent air pockets. Backfill soil shall not be compacted to a density that inhibits root growth. The goal is to restore to a similar density as the soil before the hole was dug. Water should be added, at an appropriate rate, to the root ball and backfill to bring the root ball to field capacity.

Mulch should be applied to an initial depth of 3 inches when lightly compacted. It should be applied to within a 2 inch radius, and not touching the trunk or root flares. Mulch with same material as surrounding landscape, specified in the landscape section.

Staking

Staking is not required if the root ball is stable. Trees shall be guyed loosely enough to allow trunk to sway from the base. Opposing two-stake systems are preferred. Stakes and guying should be installed to minimize hazards to people.

Wire or tubing encased wire is not to be used. Fabric and strapping specifically for staking should be installed according to instructions. Staking should remain for no longer that 1 year. Six months is preferred. Removal is the responsibility of the installer. (It’s a good opportunity to check up on the tree’s health). (Refer to Appendix B-3N)

Pruning

After planting, only dead, broken or damaged branches should be pruned using proper techniques.

Post-Construction Tree Maintenance

Tree damaged by construction as well as new transplants generally require a high level of maintenance due to stress caused by root loss. Demands for water and mineral nutrients (fertilizer) are critical due to root loss.

Tree Structure Evaluation

A thorough inspection and evaluation of tree structure should be performed before any maintenance in conducted. Careful inspection of the root zone and root flares should be undertaken to assess hazardous conditions. Branch structure, wood decay and other defects also must be evaluated and remove if needed.

Final Grading
Final site grading should provide drainage systems which divert ground water from tree preservation areas. Grading should be avoided in preservation areas.

Whenever possible, maintain trees under a layer of mulch in natural areas rather than grading and establishing turf or other ground cover.

Root Collar Excavation

During construction, soil is frequently placed against root collars of trees due to grade changes. Ensure that root flares are visible on all trees during the initial inspection. Excavate soil to expose the root collar as necessary.

Mulching

SMU requires mulch around trees. The benefits of mulch on plant growth include conserving soil moisture, supplying nutrients and organic matter, eliminating competition from weeds and ground cover plants and preventing erosion. Mulches should be applied to a depth of two to four inches. Excessive mulch can encourage shallow rooting which can be detrimental during droughts. Avoid annually top dressing mulched areas where the mulch exceeds depths of four inches. Avoid placing mulches against the root collar. Maintain a mulch ring around each tree; 1 foot of mulch for every inch of tree girth at the base of the tree.

Materials and Installation Specifications

General:

Unless otherwise stated, it is expected that the Landscape Architect will specify the landscape subcontractor to furnish all labor, material and equipment required to complete the work described herein in strict accordance maintained in conformance with the drawings and specifications.

Protection of Existing Lawns to Remain:

Do not store materials or equipment, permit burning, or operate or park equipment on existing lawn areas to remain except as actually required for construction on those areas.

Provide barricades, fences or other barriers as necessary to protect existing lawns to remain from damage during construction.

Notify Landscape Architect in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing lawns to remain.

If existing lawn areas to remain are damaged during construction, Contractor shall replace such lawn areas of the same quality as those damaged at no cost to Owner. Determination of extent of damage and value of damaged lawns shall rest with Landscape Architect and SMU representative.
Clean Up:

Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during lawn installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Landscape Architect and SMU representative. All existing landscapes that are not re-landscaped through the project and are behind a construction fence will be maintained by the project GC or their subcontractor during the life of the project. This maintenance includes proper irrigation, weeding, mowing of turfgrass, leaf and trash removal. The landscape should be returned to FS in the condition it was in the day the construction fence was installed.

Materials:

Turfgrass Sod Composition: Turfgrass sod shall be Zorro Zoysia in all part-shade locations or Celebration Bermuda in all full-sun locations. Turfgrass will not be specified in any areas that receive less than 4 hours of sunlight per day.

Turfgrass Sod Quality: Turfgrass sod shall be of good quality, free of weeds, disease and insects and of good color and density.

Thickness of Cut: Turf shall be machine-cut at a minimum uniform soil thickness necessary for plant viability during the Harvest-Transport-Installation cycle.

Pad Size: Individual pieces of turfgrass sod shall be cut to the supplier’s standard width and length.

Strength of Turfgrass Sod Sections: Standard size sections of turfgrass sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

Turfgrass should be inspected and approved by SMU prior to installation. Sod cannot be kept on the pallet for more than 24 hours. Once delivered the sod must be laid, rolled, and irrigated immediately. This means the site must be prepped and ready for the sod to be laid before the sod delivery arrives.

Grading:

Tilling: After the areas to be top soiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the sub-grade shall be loosened by diskng or rototilling to a depth of at least 3 to 4 inches to permit bonding of the topsoil to the subsoil. This process must not be done under the drip line of any tree. To prepare the soil under the drip line of any tree, the soil must be air-spaded. There can be no tilling under the drip line of any tree. Place and spread any additional material that may be required. The Contractor shall be responsible for minor adjustments to the finished subgrade if such treatment is required in the opinion of the Owner’s Representative. Hand-rake the surface, removing all of the clods and undesirable material greater than one-half (1/2”) inch, from ground surface.
Fill all low spots and cut irregularities to the acceptance of the Owner’s Representative. Roll the entire surface evenly with a water ballast roller or other means acceptable.

During the finished grading operations, all swales and additional swales that may be required to drain areas where there are existing plant materials, shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water. To prevent excessive weed growth in the lawn areas, the Contractor should be prepared to immediately install the lawn upon the completed and acceptable finished grade.

**Installation:**

Moistening the Soil: After all grading has been completed; the soil shall be irrigated within 12 to 24 hours prior to laying the turfgrass sod. Turfgrass sod should not be laid on soil that is dry and powdery.

Starter Strip: The first row of turfgrass sod shall be laid in a straight line, with subsequent rows placed parallel to, and tightly against, each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to insure that the turf is not stretched or overlapped, and that all joints are butted tight in order to prevent voids, which would cause air-drying of the roots.

Sloping Surfaces: On sloping area where erosion may be a problem, turfgrass sod shall be laid with staggered joints and secured by pegging.

Mark all irrigation heads and cut turf around them. Roll Sod.

Fertilizers: All fertilizers shall be uniform in composition and free-flowing. Fertilizer shall be delivered to the job site fully labeled according to applicable state fertilizer laws. Fertilizer application rates shall be determined by soil tests. Fertilizer shall be distributed uniformly over the area to be sodded with turfgrass.

Watering: The landscape contractor shall be responsible for watering turfgrass sod immediately during and after installation to prevent drying. It shall then be thoroughly irrigated to a depth sufficient that the underside of the new turfgrass sod pad and soil immediately below the turfgrass sod are thoroughly wet (usually 1 inch of water is needed). The contractor shall be responsible for having adequate water available at the site prior to and during installation of the turfgrass sod.

**Acceptance:**

Acceptance shall be given by the contractor, owner, architect or his/her agent upon satisfactory completion of each section or area as indicated on the drawings or as otherwise specified. Acceptance should be recorded by the party responsible for the site preparation, and it should be signed by the owner or agent. No Top-soiling or Turfgrass sod installation work should precede until this requirement is met.

**Guarantee:**
The landscape subcontractor shall guarantee work covered by this specification.

**Contractor’s Responsibility:**

Unless otherwise specified, the Contractor shall be responsible for maintaining the accepted sodded turfgrass areas until the effective date for turf maintenance operations begins. The effective date shall be specified in a written notice from the Contractor.

**Design Phase for Ornamental Plants**

Selection of species is to be determined by the Landscape Architect. Conceptual or Design Development design plans shall be submitted to Facilities for final approval. Plans shall contain: proposed plant type, container size, placement, irrigation needs, height of plant, shade, wind patterns, sidewalk placement. The Landscape Architect can obtain a plant list from Facilities prior to preparation of the conceptual design. Plant materials must be drought tolerable/low water usage, native or adapted to North Texas environment, and tolerable for existing soil conditions.

**Soil Preparation and Planting Procedures for Ornamental Plants**

**Bed Preparation**

Before planting, survey the site for potential hazards to plant growth. For instance, new construction sites are often littered with pieces of mortar, plaster or limestone, creating an alkaline soil condition and inhibiting a plant’s ability to absorb nutrients. Chemical spills, such as motor oil or gasoline, can also impair plant growth. It may be necessary to remove the top six to eight inches of soil and replace it with a good grade of screened topsoil. Compacted soils also inhibit root growth.

Poor drainage of clay soils causes plant problems in central and north Texas. A water-logged soil will suffocate the root system and kill a plant if not corrected. Slope planting beds along the foundation away for the building and route water from drain spouts away from plant beds. Improve poorly-drained sites by deep tilling to break apart a layer of hard packed soil, or “hard-pan,” several inches below the soil surface. After properly grading and removing all construction trash and debris, the areas that will be planted with groundcover, shrubs, herbaceous perennials, annuals, etc. must be tilled. Till all areas to be planted to a depth of 12”. Then the areas must be amended with 12” of a high quality planting mix as specified by the Landscape Architect. Then incorporate an all-purpose, granular organic fertilizer. The planting mix and the fertilizer must then be tilled into the existing soil to a depth of 12”. Grade the soil to ensure good drainage and to avoid standing water. There can be no tilling under the drip line of any tree. After planting apply 2” to 4” of mulch to the top of the soil surface to conserve moisture and prevent weeds. Keep mulch away from the base of each plant. There should be no actual contact between the mulch and the plant itself. Areas to be planted under the drip line of any existing tree must be cultivated using an airspade. Before using the airspade the soil must be moistened to a depth
of 12”. If the soil is not adequately wet the airspade will not work. Add 2” of compost to the top of the soil and then airspade to a depth of 12”.

Selecting and Planting Plants

Always purchase fresh, high quality plants. Container-grown plants should have healthy, vigorous tops and white feeder roots on the outer edge of the root ball. Examine the plants for girdling and overgrown root systems. The roots should be white. Dark roots can indicate problems. Container-grown plants generally transplant well throughout most of the year with minimum shock, although fall and winter months are the best time to transplant. Because a large portion of the balled-and-burlapped plants root system is destroyed during digging, they transplant best during the cooler months of the year (October through April).

If plants cannot be planted right away, place them in a shaded area and keep the roots moist. If balled-and-burlapped or bare-root plants must be held several days before planting, cover their roots with soil to conserve moisture. Avoid placing the roots in buckets or water for long periods of time. Container plants may need daily watering. Plants must not be allowed to dry out before and/or after planting.

All plants must be approved on site by a representative from SMU’s Project Manager. Therefore the contractor or sub must contact a Facilities project manager every time plant material, turf, and/or trees are delivered, prior to installation. Photos of the plants will not suffice. SMU reserves the right to refuse plant material that we deem poor quality.

Plant Spacing

Groundcovers - All groundcovers (Asian jasmine, Liriope spp., Ophiopogon spp., Aspidistra, etc.) must be in 1 gallon containers or larger, no 4” pots. SMU reserves the right to refuse plant material based on container size and quality. One gallon groundcovers should be spaced close enough to give the appearance of a mature landscape thus all groundcovers should be spaced approximately 1’ on center, no further.

Shrubs - All shrubs and roses must be in 3 gallon containers or larger. The shrubs must be spaced close enough to give the appearance of a mature landscape. The spacing for all shrubs should be 4” from the outer edge of one plant to the outer edge of the next plant. SMU reserves the right to refuse plant material based on container size and quality.

In shrub beds, a minimum of 12” will be left open between the outer row of irrigation heads and the front of the shrubs to prevent the spray from being blocked.

Herbaceous Perennials - All herbaceous perennials must be in 1 gallon containers or larger. The perennials must be spaced close enough to give the appearance of a mature landscape. The spacing for all perennials should be 3” from
the outer edge of one plant to the outer edge of the next plant. SMU reserves the right to refuse plant material based on container size and quality.

**Annuals** - All annuals must be in 4", 1 gallon containers, or larger. The spacing for all 4" pots should be 6" on center. The spacing of all 1 gallon annual plant material must be 8" to 12" on center. SMU reserves the right to refuse plant material based on container size and quality.

**Planting in Individual Holes**

When you are planting individual trees and shrubs, dig a large planting hole. Dig a hole twice as wide as the root ball to encourage rapid root growth and larger, stronger plants. Dig the planting hole to the depth of the root ball and no deeper. If the hole is dug deeper than needed, backfill the soil as necessary and tamp it firmly to prevent settling. Make certain the top of the root ball is level with the soil surface. Prior to backfilling, expose the root flair to make sure that it does not get planted below the soil level. Make any adjustments at this time such as raising the hole level and then backfill. Do not add any organic amendments, such as peat moss, pine bark and leaf mold, to the soil. Simply backfill with same soil removed from the hole after breaking apart any clods and removing stones or other debris.

Before planting balled-and-burlapped plants cut any wire or cord from around the trunk (remove from plant) and pull back the burlap from the top third of the root ball. This will allow newly formed feeder roots to grow into the new environment. When planting on poorly drained soils, remove the burlap completely. Make sure to remove the entire bag before planting when using ornamentals grown in fabric bags. As the backfill soil is placed in the hole, water to eliminate air pockets. Use your hand, not your foot, to gently firm the soil around the roots. Water the pants thoroughly when finished and water again several hours later. Do not add any type of fertilizer at this time.

Finally, shape a small ring of soil along the perimeter of the planting hole. This helps direct water to the roots and prevents runoff. Then apply a three-inch layer of mulch uniformly over the soil surface. Keep the mulch away from the root collar. Mulches promote rapid rooting by maintaining uniform moisture levels and temperatures in the soil and by preventing weed competition. Water the newly planted tree immediately and thoroughly.

**Planting in Beds (Annuals and Herbaceous Perennials)**

A group of ornamentals in one area of the landscape will grow more uniformly when planted in a well prepared bed rather than in individual hole. Begin by deep tilling to a depth of 12 inches. At this time, elevate the bed 6 to 12 inches by adding soil amendments, compost or premium bedding mixes from Soil Building Systems, Vital Earth, or LETCO. A raised bed not only ensures good drainage, but also improves the visibility of the color...
display. After planting, apply about two inches of mulch on the soil surface to conserve moisture and prevent weeds.

**Care of Newly Planted Ornamentals**

Regular watering is critical during establishment. Keep the root system moist, but not too wet, for the first six to eight weeks after planting. The amount of water and frequency of application depends on the soil type, plant and time of year. Trees and shrubs may require watering twice a week when there is no rain. Annuals and ground covers may need daily watering during establishment. In the summer or dry periods or in the winter when there is a threat of freezing temperatures, plants may need to be hand watered to supplement the irrigation system. The contractor must monitor to know when hand watering is required. Let soil moisture be your guide for watering frequency.

If specifying general-purpose fertilizers, use light applications for newly-planted ornamentals during the first growing season. Broadcast fertilizers evenly over an area extending six inches from the trunk to one foot beyond the branch spread or canopy. When broadcasting fertilizers over the tip of the foliage, be sure the foliage is dry, and water immediately after application. Mulch all newly planted beds with specified bark mulch.

**Landscape Establishment Period**

A quarterly walkthrough and inspection of all landscapes that are in the landscape establishment period will be set up by Facilities and will include a Facilities project manager, FS Grounds Manager and FS Sr. Irrigator, and the landscape contractor. The results of the inspection will be shared with all parties. Requirements for an LEP will be developed, revised and approved by SMU, (Facilities, FS and landscape architect), as part of the project specification.

The landscape contractor will communicate via email to FS’s Sr. Irrigator when programming changes are needed. The contractor will provide the program schedule in the email.

**Number of plants required per 100 Square Feet at Various Spacing:**

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<thead>
<tr>
<th>Spacing (inches between plants)</th>
<th>Number of Plants Needed</th>
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LEED Building Landscapes

In all landscapes around LEED buildings the foundation plantings must be 12” – 18” away from the exterior wall of the building. Thus plants must be planted at such a distance to maintain this gap. Consider the size of the mature plant when establishing the proper distance to maintain this gap.

Landscape Irrigation Systems

The Design Team shall include in the Contract Documents that the Contractor shall provide/maintain irrigation (temporary or otherwise) to affected areas outside of the immediate construction contract limits. The Design Team shall also include in the Contract Documents that the Contractor to have an English-speaking person on site at all times. The Contractor shall notify Facilities immediately of any damage to the irrigation system in order to prevent flooding, and loss of irrigation to plants. Facilities will then immediately notify FS so that the FS’s Sr. Irrigator can make necessary adjustments and be knowledgeable of the situations. Adjacent areas shall be inspected by the SMU Grounds Department for damaged wires, lines, heads, etc. at the end of the construction phase. The Owner may elect to perform daily irrigation test to ensure systems are still functioning properly, and not leaking. The daily test will be conducted for one-minute per zone in the mid-afternoon. Damage that is located will be repaired on the same day by the Owner, and paid for by the Contractor.

Drip irrigation may be used in groundcover beds and shrub beds. For existing systems, SMU will perform a preconstruction walkthrough with the Contractor to inform of existing and adjacent irrigation systems. This walkthrough is to show: the system is functioning, locations of valves and heads, and piping layout. The FS Sr. Irrigator will attend by invitation of Facilities this preconstruction walkthrough to inform and answer all questions that the contractor may have about the irrigation system.

During the design phase, the Design Team shall develop an irrigation plan. This irrigation plan shall be reviewed by Facilities’ Sr. Irrigator. Facilities’s Sr. Irrigator shall inspect each phase of the Landscape irrigation system. This includes: excavation and pipe laying, wiring, valve placement, impact on and restoration of service to areas that have been impacted by construction areas. The designing of the irrigation system can either be a performance specification or designed by a Landscape Architect. Facilities’s Sr. Irrigator will review the irrigation design, and CAD files will need to be provided to the University for Project Record Documentation.

Gray water systems shall be used. This system can be used for both LEED and non-LEED projects. Notation shall be on the sprinkler controller for identification of the gray water system. It is encouraged to use non-clog heads for this system. The non-clog heads will need to have a colored top cap in order to differentiate it from the regular heads. The Contractor will need to coordinate
with Facilities in regards to initial programming for the zones and clock timer settings for the irrigation system.

During Construction, there shall be no storage of materials on established landscape areas, as well as no on-site storage of materials within a close proximity of tree drip lines. Construction team shall not bury construction material and debris. Sites shall be completely leveled-off, and graded, after tear down and deconstruction of projects.

Refer to Appendix B-3E for Irrigation Specification.

**Site and Street Lighting**

- Normal
  - 0.5 fc average
  - 6-1 average to minimum ratio
  - 10-1 maximum-to-minimum ratio
- SNL- (Special Needs Lighting)
  - 1.0 fc average
  - 6-1 average to minimum ratio
  - 10-1 maximum-to-minimum ratio

**Outdoor Lighting Circuits**

Each outdoor lighting circuit shall be at least two circuits. This is to provide at least one working circuit in case one circuit fails. Circuits for outdoor lighting shall be 120V/208V only. Higher voltage tends to short out. No below grade exterior lights shall be used without approval by Facilities. There shall be no in-ground junction boxes. Luminaries and pole will be the only allowed junction box.

**Light Fixtures**

- Campus Lighting Map: Refer to Appendix B-3G.
- 12’ and 10’ lights shall be Sternberg Main Street LED.
- SMU prefers not to have lighting in trees.

**Site Furnishing**

**Benches (Campus Standard)**

- Wood, Cast Stone, or limestone.
- Location as determined by Design Team and Facilities.
- Stone Benches: Refer to Appendix B-3H.
Trash Cans (Campus Standard)

- Refer to Appendix B-3J.
- There should be a minimum of four trashcans per building. It is preferable that a trashcan be located next to or within approximately 30’ of any entrance. In the landscape around any new building there should be a trashcan at any cluster of seating. The exact locations will be determined by Facilities.
- In a pedestrian mall there should be a trashcan at any cluster of benches or seating area made up of more than one bench or one trashcan for every five benches. Pedestrian malls should have at least 3 trashcans for each 13,500 square feet in addition to the ones placed at seating areas.
- For budget purposes the trashcan, liner, and lid cost $788. They require at least one month to manufacture and deliver.
- Trashcans should be ordered by the project’s construction manager or general contractor.
- Trashcan liners must have a lip around the top to help hold the trash bag in place. Without it the bag will fall down. The liners come with the trashcans when ordered from Jackson Pottery. Refer to Appendix B-3J-3.
- Trashcan lids are ordered separately. Refer to Appendix B-3J-2.

Cigarette Urns (Campus Standard)

- There should be a minimum of two ash urns per building. They will be placed in the landscape and must be at least 25’ from any exterior entrance/exit door. The ash urns are best located next to a seating area. The exact locations will be determined by Facilities.
- In a pedestrian mall there should one ash urn for every five benches. The exact locations will be determined Facilities.
- Ash urns will be ordered by the contractor and paid for by the project. For budget purposes an ash urn costs $257. This can be done in the planning phase or after the building and landscape is complete.
- Ash urn bowls should be ordered for each ash urn by project/Facilities.
- Ash urn bowls should fit into ash urn properly.
- SMU will supply and fill the ash urn bowls with the black ash filler at the end of the project.
- Refer to Appendix B-3K.

Bollards

- Shall be aluminum unless otherwise required for design.
• Location is to be determined on a case-by-case basis, and shall be confirmed with the applicable Fire Marshall.
• Knox padlocks, as well as campus locks will, be required.
• Refer to Appendix B-3L-1.

Bicycle Racks
• Campus Standard: powder-coated steel pipe loops.
• Bike racks must be ordered by the contractor of the project and installed properly.
• Each bike rack must be embedded in the concrete, no above ground mounting.
• Must be on a concrete pad.
• Location: as determined by Design Team and Facilities.
• Refer to Appendix B-3M.

Steel Landscape Edging
• Dark green, metal landscape edging will be installed between all turf and shrubs beds and all turf and groundcover beds.

Area Drain Grates
• All area drain grates will be made of metal and substantial enough to withstand the occasional weight of a cart.

Site Furnishings required to be temporarily removed during construction and stored to avoid damage shall adhere to the following:
• Inventory of items tagged and photos with signature of Facilities Project Manager.
• Contractor shall be responsible to store all items in secure location.

END OF SECTION
PART B-4

BUILDING CONSTRUCTION AND MATERIALS

INTRODUCTION

This section addresses overall concepts and preferences for building assemblies and systems. Any variances with these preferences indicated shall be approved by Facilities.

BUILDING CONSTRUCTION PRINCIPLES

The design team shall design each structure anticipating a 50-year plus life span. Designs shall also take into account the possibility of the building use changing in later years.

BUILDING SHELL AND ENVELOPE

Basements

During the programming phase, the Design Team in conjunction with Facilities shall determine if the building will require a basement and/or a crawlspace. The basement shall require the following for insulation purposes:

- Constructed of concrete walls
- Waterproofed (on exterior side)
- If the basement is conditioned, it will also need to be insulated
- High heat areas (areas containing boilers or other heat generating equipment) shall be insulated from other occupied spaces

The Design Team is responsible for reviewing the Geotechnical Report and providing the following means for dealing with sub-surface water:

- Provide waterproofing for below grade walls and slab
- Provide perimeter foundation drainage system. Refer to Appendix B-4H-1.
- Provide sump pump(s) that are either piped to the storm drainage system or to the rainwater collection system. This shall be determined by Facilities.

At any point at which there is a need to connect to the utility tunnel system, all connections shall be rodent proof. (Campus cats are not allowed in the tunnels.) This system must be hinged and operable from both sides and fit tightly around the penetrations. Bolted panels are not allowed.

Crawlspace

Crawlspace shall be constructed with a mud slab (gravel or dirt are not permissible). Crawlspace shall have an intake and exhaust for ventilation. The crawlspace shall be insulated, and have an underslab sheet vapor retarder under the mud slab, and termite protection.
From the top of the mud slab the crawlspace clearance shall be (1) a minimum of 30” from the lowest structural member, or (2) 24” minimum from the underside of any mechanical or electrical obstruction. The Design Team shall coordinate any mechanical systems with the structure to ensure that these minimum clearances are met. Care should be given to coordinate utilities in a common “Utility Zone”.

Access points to the crawlspace shall be by a floor access hatch, and the Design Team shall coordinate locations with Facilities. Crawlspaces shall have a minimum of one access point. The “Utility Zones” shall have a minimum of one access point for each zone. Final locations and quantities of access points to crawl space shall be coordinated with Facilities.

**Superstructure**

The Superstructure shall be reinforced concrete. Any other format will be at the discretion of SMU.

**Attics and Attic Access**

The Attic shall be the uppermost story of the building. The space is typically not conditioned, and is used primarily for mechanical equipment. “Wet” mechanical equipment (pumps, condensers, water heaters, etc.), shall be provided with a perimeter containment curb (4” in height to be sealed concrete or 2” x 2” galvanized angle iron/aluminum. All equipment will be mounted on 6” concrete housekeeping pads within the containment area. Concrete housekeeping pads shall have 45 degree relieved edges. Containment areas shall be waterproofed and sloped to a floor drain. Any duct or pipe penetrations in attic slab, even if not in containment curb, shall be water sealed. The Attic floor shall be sound proof, with a minimum of 50DB (60DB preferred).

Access to the Attic space will be primarily for maintenance personnel. Allowance shall be made hoisting equipment such as air handlers, pumps, water heaters, motors, elevator equipment, etc. Options include:

- One set of stairs may extend up to attic
- Alternating tread-stairs, with hoist point above
- Access hatch with hoisting point above
- All Access to Attic to meet applicable codes.

Access hatch shall be a minimum size of 3’-0” x 4’-0” or larger as needed in order to accommodate the largest piece of equipment anticipated for the Attic space and clear of any obstructions. Access hatches will have the ability to lock in the open position by mechanical means. The hatch will be able to be opened with one hand and no more than two movements.

One story, flat roof access may be by portable ladders supplied by the maintenance staff. It is preferred to have internal ladder/stair to access roofs of all buildings, one story and higher. Two stories or higher shall be through means of access from the building whether it is through an access door or window. The doors and windows used for roof access shall follow the architectural design of the building. Accessible windows shall be operable.

Access from the Attic to adjacent flat roofs shall be through an access point from the Attic leading to the roof, and keeping with the architectural design of the building. Exposed external ladders are not allowed unless the ladder cannot be seen from ground level or the occupied space.
**EXTERIOR ENCLOSURE**

**Cladding**

The cladding shall be comprised of:

- Exterior walls are to be of brick and cast stone or limestone. The choice of limestone is dependent upon cost. Any other material is at the discretion of SMU.
- Back-up wall system shall be metal stud. When appropriate, masonry walls may be utilized for mechanical rooms and fire stairs.

Stonework shall have sealant joints. Mortar joints are not permitted. Reference Cast Stone and Limestone Accents & Trim section in Part B-4 for more information.

**Roofing**

Roofing and flashing shall comply with NRCA details and recommendations. Flashing details shall also comply with SMACNA.

For sloped roofs natural slate is the preferred material, in a three nail installation. The Design Team shall recommend the color, and the thickness shall be 3/16”. The natural slate shall have a 50 year warranty. Flashing may be stainless steel or copper. Simulated slate shall also be considered in order to help contribute to LEED points. This shall also contain at a minimum of a 50-year warranty.

Low –Sloped roofs (flat roofs) shall be a Modified Bituminous roofing system with a white or light colored cap sheet for reflectivity (to meet LEED) Heat Island roof requirements) with copper or stainless steel flashing. Low Sloped roof slope must be sufficient to allow proper drainage and meet all local code requirements.

**Roof Drainage**

Sloped roofs shall contain the following:

- Internal concealed copper gutters.
- Internal concealed leaders.
- All concealed roof drains leaders shall be constructed of PVC or cast iron and shall be in a sound insulated chase. Piping must also be insulated to avoid condensation. Joints and fittings are to be accessible for maintenance purposes through access panels.
- Exposed overflow outfall with lamb’s tongue (ADA-compliant when adjacent to walkways).
- Downspout leaders to be connected to subsurface storm water drainage system
- All shall be architecturally integrated
- All exterior downspouts, if utilized and approved by SMY, shall be copper.

Low Slope roofs are to contain the following:

- No scuppers

All drains are to be internal and to be of cast iron or PVC insulated pipe and constructed in an insulated chase. Joints and fittings shall also be accessible for maintenance purposes through access panels.
Architectural Elements and Features

All materials that are used on the buildings on the SMU campus shall be low-maintenance, and shall be integrated in the overall architectural aesthetic of the campus.

Balcony Railings:

Balcony railings shall be made of non-ferrous metals, fiberglass, and/or cast stone. Hardware and fitting attachments shall be stainless steel. The University does not permit ferrous metals. Balcony railings shall be white or as determined by Facilities.

Decorative Metal Grilles:

Decorative metal grilles shall be a non-ferrous metal or fiberglass. Any hardware and fitting attachments shall be stainless steel. Color to be determined by Design Team and fitting with the architectural design.

Dormers:

Dormers are used on the buildings primarily for aesthetics, but also for attic air intake and ventilation. The dormers shall be made of a low-maintenance material, and can be pre-fabricated. Any hardware and fitting attachments shall be stainless steel. Dormers shall not be made of painted wood.

Louvers:

Louvers shall be an extruded aluminum or copper with color finishes required to integrate with the architectural aesthetics. Any hardware and fitting attachments shall be stainless steel, or dielectrically compatible hardware.

Cupolas:

Cupolas will be decided upon on a case-by-case basis. The design of the cupolas shall be consistent with the Collegiate Georgian Architectural style on campus. Cupolas are not intended to match other Cupolas existing on campus. Cupola lighting shall be internal or integrated into a skylight, all of which shall be approved by Facilities. Clocks are to be as determined by SMU.

Conduits and Panel Boxes:

Care should be taken to ensure conduits, panel boxes, and other MEP elements are not exposed. These should be integrated into the design of the building without compromising the aesthetics of the building’s design intent.

PRODUCTS, MATERIALS, AND SYSTEMS

MASONRY

General Design Criteria

Designs shall maintain the existing Collegiate Georgian architectural style on the main campus. Design Team shall include in the Construction Documents provisions for construction of mockup panel(s) for review and approval of brickwork and stone (cast stone or limestone). The manufacturer will be required to provide written documentation the brick/stone delivered to site is that which has been
approved. Additionally, SMU may require selected palettes of brick/stone to be broken open for review and confirmation.

Brick:

New Construction: As recommended by Architect; final selection and approval of proposed brick will be made by University President. Care must be taken to select a brick that will fit within the context of the existing campus.

Additions and Renovations: To match existing brick of the building on which it is being installed.

Brick Coursing:

Typically running bond. Architect to consider other existing formats on campus when making recommendations for brick coursing.

Special Brick Accents:

It is understood portions of buildings and building elements, will be require special coursing and features in order to maintain consistency with the overall Collegiate Georgian architectural style. Brick and stone (cast stone or limestone) quoins, soldier courses, Jack arches, keystones, etc., to be utilized at the discretion of the Design Team, but must be consistent with existing campus architecture and designed in accordance with industry standard.

Jack Arches:

Design Team shall adhere to the following:

New Additions to Existing Buildings: Arch size; configuration; and brick size, shape, and coursing; etc., of new jack arches to match those on the existing building.

New Construction: Provide true Jack arches, constructed of special brick shapes, in accordance with Brick Industry Association (BIA) Tech Note 31 - Brick Masonry Arches, and the details included in Appendix B-4A.

Mortar:

General

Mortar should be mixed and proportioned in compliance with applicable ASTM standards.

Products

Mix mortar using Portland cement or Portland cement and lime only. Masonry cement is not to be used unless approved by Facilities. Mortars should be of color that matches existing buildings on campus for new construction. Mortar mixes shall follow the same approval process as the brick.
Execution

Mortar joints exposed to weather or exposed to view shall be concave tooled joints. All other joints, (i.e. within cavity walls), shall be struck flush with the masonry unit. Joint thickness should be 3/8” for new construction, and should match existing joint thickness for renovations and additions.

Concrete Masonry Units

General

Concrete masonry units and all reinforcing and anchorage accessories should be specified to be in compliance with, but not necessarily limited to, applicable ASTM standards, ACI Masonry Standards, and the National Concrete Masonry Association.

Products

Ground face or split face block should not be used at exterior facing unless approved by Facilities. Concrete masonry units may be light weight or normal weight. Reinforcement and anchorage accessories should be hot dipped galvanized.

Through-wall and cavity flashings should be stainless steel or laminated copper sheet. PVC flashings are not permitted.

Execution

When used at exterior wall the cavity wall side of the concrete masonry units shall receive an air/weather barrier coating; product to be specified by the Architect. Reinforcement, anchors, and ties in exterior wall construction should be hot dipped galvanized. Open-mesh or vent-type weep systems that utilize full open head joint are preferred. Cotton rope weeps or plastic tubes are not desired. Head and bed joints shall be full with tooled concave joints.

Brick

General

Brick units and all reinforcing and anchorage accessories should be specified to be in compliance with, but not necessarily limited to, applicable ASTM Standards, The Brick Industry Association, ACI Masonry Standards, and the National Concrete Masonry Association.

Brick selection is subject to the review and approval by the University President for all projects. Consideration should be given to compatibility of color and texture with existing brick on campus.

Products

Face brick should comply with ASTM C216, grade SW, Type FBS. Material delivered shall be free of damage.

Execution

Cavity walls are to be kept clear of mortar droppings. Mock up wall panels should be specified, incorporating all elements of the cavity wall construction including stone trim, flashings, sealants, and windows. Minimum mock-up wall panel should measure 6’ wide x 8’ high. Head and bed joints shall be full with tooled concave joints.
Cast Stone and Limestone Accents & Trim

General

Cut limestone/cast stone is subject to review and approval by Facilities for all projects. Consideration should be given to compatibility of color and texture with existing stone on campus. Final approval is by the University President. Planters and retaining walls need to have skateboard prevention devices. They must be reviewed and approved by Facilities.

Products

Cast stone materials shall be minimum 6000 psi, and fabricated by “dry-tamp” method produced by a member of the Cast Stone Institute.

Stone anchors, dowels, and other fasteners in direct contact with cast stone or cut limestone should be stainless steel.

Execution

Set stone units in setting mortar, raking back all joints 3/8”, and filling with sealant with concave tooled sealant joint. Bond breaker tape shall be used. Limestone is discouraged on exterior surfaces.

Masonry Cleaning and Restoration

General

Exposed masonry should be cleaned to remove excess mortar, dirt, efflorescence, and stains. Methods and materials used should be controlled to prevent damage to masonry and other work, and should be environmentally friendly.

Products

Materials used should be as recommended by Contractor. Triple J Solutions and Renew are two contractors that have a relationship with the University and have used successful chemicals in order to clean both the brick and stone on the campus. SMU has had success with cleaners manufactured by ProSoCo. All chemicals shall have a low-pressure rinse after application. Acid cleaners and sand blasting are not desired.

Execution

Precautions and care shall be taken by the Contractor so as not to damage finished metal items (windows, frames), glass, and plantings during masonry cleaning operations.

Waterproofing

General

At the conclusion of each new building construction, all exterior cast stone surfaces will be “sealed” using a Siloxane/Silane blend material, per manufacturer’s recommendation. A written warranty will be provided by the construction contractor upon application. The surface will be tested prior to the conclusion of the initial building warranty to confirm the integrity of the application. This will be accomplished by application of water sprayed on the surface to confirm water repellency.
Products

Building will be cleaned per general instructions of Masonry Cleaning and Restoration, covered preceding this section. Product for sealing of buildings will be Prime-A-Pell H2O Series 633 (or equal).

Execution

Care is to be taken to follow the instruction published by the Sealer Manufacturer.

Ongoing Maintenance

Exterior Cast Stone areas will be resealed per Manufacturer’s recommendation (but at least every five (5) years.

METALS

General Design Criteria

Materials and appearance: At the discretion of the Design Team, but must be consistent with existing campus architecture.

Interior Stairs and Handrails: At the discretion of the Design Team.

Exterior Stair and Ramp Handrails: Galvanized steel, painted galvanized, stainless steel, and aluminum.

Embedded sleeves, pin, and attachments for handrail supports must be stainless steel.

WOODS, PLASTICS, AND COMPOSITES

General Design Criteria

Materials and appearance: At the discretion of the Design Team, but must be consistent with existing campus architecture.

Materials selection must take into account sustainability/LEED.

Wood Composites: No formaldehyde.


Woodwork Finish: May be painted or stained, as determined by Design Team.

Plastic Laminate or Wood Veneer: As determined by Design Team.

Should be FSC Certified (including rapidly-renewable).

For exterior and interior woodwork, where trying to match existing special profiles, “Fypon” or similar simulated wood trim product can be used as a suitable substitute for exterior applications. It may also be used in lieu of cast stone, upon approval of Facilities.
THERMAL AND MOISTURE PROTECTION

General Design Criteria

Waterproofing: Provide at all crawl spaces (exterior surfaces of perimeter grade beams), and basements. Product to be selected by Design Team.

Design Team shall include sheet drainage panels and perimeter foundation drainage system (with gravel trench and geotextile fabric).

Introduction of impervious clay caps shall be reviewed with Facilities prior to inclusion in Construction Documents.

Design Team must perform dew point vapor analysis to determine if vapor retarder is required, and location within the wall assembly. Results of analysis shall be reviewed with Facilities prior to conclusion of Design Development Phase.

ROOFING AND ROOF DRAINAGE: REFER TO PART B4 ARTICLE “EXTERIOR ENCLOSURE.”

DAMPPROOFING AND WATERPROOFING

General

Foundation walls and grade beams shall be scheduled to receive a damp proofing coating where there is no internal occupancy. Foundation walls should receive a waterproofing coating where there is internal occupancy or building support spaces (mechanical, electrical rooms). Elevator pits should receive a waterproofing coating.

Products

Damp proofing and waterproofing coating products should be suitable for the building condition, details, and geographic region.

Execution

Installation of damp proofing and waterproofing products shall be performed by a firm having at least 10 years of documented successful experience in the application of the specified products.

BUILDING INSULATION AND VAPOR RETARDERS

General

Building envelope should receive appropriate insulation and vapor retarder (if required), consistent with recommendations of dew point vapor analysis and minimum code required ‘R’ and ‘U’ values and as appropriate for the geographic region, building function, and indoor climate control requirements.
Products

Building insulation should be either rolled batt, or rigid extruded board. Expanded foam products and expanded polystyrene (bead board) shall be avoided. Vapor retarder materials can be sheet goods or liquid.

Execution

Installation of building insulation and vapor retarder/barrier products shall be performed by a firm having at least 10 years of documented successful experience in the application of the specified products.

OPENINGS

General Design Criteria

The Design Team shall consult with a representative of Facilities during preparation of the Door Schedule to determine the function of each door and required locations of access control products. A general preference for exterior doors is fiberglass reinforced polyester (FRP).

Doors and Frames

Metal Doors and Frames

The metal door and frame specification must contain the following:

- Use of specified manufacturer’s products that have continuous steel channel framed door construction (Curries 707/747 as reference standard). Acceptable Manufacturers: Curries, CECO, Steel Craft.
- Cross corridor door & frame assemblies to utilize low profile design.
- Concealed vertical rod exit shall not be utilized unless application requires it.
- Reinforcement for continuous hinges to be full height for frames; recommended gage specified by hinge manufacturer.
- Minimum Gage:
  - Frames: 16 Gage Galvanized at interior and exterior openings.
  - Interior Doors: 18 Gage Interior.
  - Exterior Doors: 16 Gage Galvanized.

Fiberglass Reinforced Doors

- Reinforce doors for door closers and other applicable hardware.
- The design and specification of the door must be approved by Facilities.
- Acceptable Manufacturers: Special-lite; Commercial Door System.

Wood Doors

The wood door specification must contain the following:

- Wood doors shall be constructed of SCL (Sub-structural Composite Lumber) material and carry a lifetime warranty.
- Wood doors shall match existing veneer and finish on renovation construction. Consult with Facilities for veneer and finish for new construction.
• Fire doors shall comply with UL10C. Intumescent seal shall be supplied in the door on rated openings.
• Acceptable Manufacturers: Algoma, Graham, Maiman, Marshfield, Eggers.

Aluminum Doors and Frames

Aluminum Doors shall be used only upon the approval of Facilities.

The aluminum door and frame specification must contain the following:

• All Aluminum doors shall have a 6-inch stile with a minimum bottom rail of 10 inches, and a minimum top rail of 7 inches. A center cross rail shall be used for doors with exit devices.
• Reinforcement for continuous hinges to be full height for frames and doors; recommended gauge specified by hinge manufacturer.

DOOR HARDWARE

Refer to Appendix B-4B.

WINDOWS, GLASS, AND GLAZING

General

Prefabricated window units are to be designed with the campus context in mind.

Products

Window units and curtain wall elements are to be thermally broken extruded aluminum construction, commercial grade.

Window units are to be factory pre-finished in fluoropolymer coating or anodized in a color to be determined by the University. Custom or metallic flake finishes are to be avoided.

Operable window units will be determined on a project-by-project basis

Glass for window or curtain wall elements is to be energy efficient, 1-inch insulating glass.

Execution

Installation of window and glass elements is to be performed by a firm having no less than 5 years of documented successful installations, and who is an approved installer by the window manufacturer.

Water hose tests are to be specified when window or curtain wall construction is field assembled or “stick built.”
OVERHEAD DOORS

Products

Overhead doors, whether exterior at loading docks or internal should be electrically operated, with start, stop, and limit switches.

Overhead doors at loading docks are to be factory primed in a color closely matching the field applied finish coat. No pre-finished overhead doors or custom colors should be specified.

Execution

Installation of overhead doors and associated components shall be accomplished by an authorized and manufacturer's approved installer.

ACCESS PANELS

General

Installation and location of access panels should be specified to be carefully coordinated with mechanical, electrical, and plumbing equipment. Coordinate quantities and locations with Facilities. Avoid object protruding below the plane of ceiling that might interfere with sprinkler head coverage resulting in violation with NFPA 13. Access panels shall be provided of sufficient size (2’ x 2’ minimum). All access panels installed in common area spaces shall have a keyed locking device. All access panels shall be keyed alike.

Products

Provide prime painted steel doors for installation in interior walls and ceilings scheduled to receive painted finish.

Provide stainless steel or aluminum doors for high moisture areas, foodservice applications, restrooms, tiled walls, exterior locations, etc.

Execution

Installation and location of access panels are to be carefully coordinated with mechanical, electrical, and plumbing equipment to which access is required. Coordinate locations with Facilities.

Stainless steel/aluminum access doors shall be installed with stainless steel fasteners.

FINISHES

General Design Criteria

The project team will coordinate all finishes (interior) with the Facilities Interior Design Manager. For renovation projects, consider the building’s character and existing finishes. All material patches should blend as closely as possible. When selecting any material, factors to consider are:

- Maintenance
- Safety
The university encourages the use of SMU colors. The design team should refrain from using any colors that are representative of other colleges or universities in the area.

The following finish applications are preferred in these typical areas on all projects unless noted or stated otherwise by the Project Manager:

- All material patches should blend as closely as possible. Mechanical rooms and fire stairwells: Provide masonry walls at all walls, mechanical rooms and fire stairwells. Fire Stairwells are predominantly masonry walls.
- Lab Areas: Consider wash-down and moisture-prone areas to be masonry, especially at cage wash areas.
- Restrooms: Full-height tile is preferred.
- Janitor’s Closets: Must have cleanable and water-resistant wall surface (i.e. FRP). Wainscot shall extend up to a minimum of five feet high.
- Food Service Areas: Per local Health Department requirements.
- Color-through homogeneous materials are preferred. Avoid custom designed colors and finish materials. Avoid materials that require routine sealing or significant, specialized maintenance. Attic stock shall be specified and provided in quantities as requested by Facilities.
- Minimize the number of paint and carpet types on a project. SMU maintains a current list of standard paint colors. Contact the Facilities Interior Design Manager for this list.

The Design Team must submit to Facilities detailed finish and material schedules along with one set of material finish boards showing all interior finishes labeled to correspond with the finish and material schedules. Contact the Facilities Interior Design Manager for criteria of finish boards.

**CEILINGS**

**Acoustical Ceilings Tiles/Panels**

**General**
The design and application of acoustical panel ceiling assemblies and acoustical wall panels are to be carefully considered for the use of the space. All ceilings should be designed to be easily accessible for maintenance and other access requirements.

**Products**
Acoustical panel ceiling grid shall be prefinished aluminum 15/16”, as standard. Stainless, aluminum, or fiberglass grids are to be used in high moisture and high humidity areas.

Acoustical ceiling panels shall be 2x2 (preferred) or 2x4 tegular edge. Custom designs, colored fabric coverings, and patterns should be avoided.

Use of ceiling panels greater in size than 24” x 48” should be avoided.

Attic stock shall be specified and provided in quantities as requested by Facilities.
Execution
Installation of acoustical panel ceiling assemblies shall be performed by a firm having no less than 3 years of documented successful installations.

Temporary grid support wires shall be completely removed from the framing upon installation of the ceiling panels. Grid support wires shall not be attached to mechanical hangers, “Unistrut,” brackets or the like. Grid support wires shall be fastened to the building structure spaced as required by the manufacturer.

Sprinkler heads and lighting must be centered in the ceiling panels and clear of lighting fixtures.

**Textured Ceilings**

**General**
The design and application of drywall and plaster should carefully consider the use of the space.

**Products**
Gypsum board products should be packaged in a manner to prevent damage during shipment. Materials should be obtained from the closest source as possible. Selection of texturing compounds shall take into account ultimate desired texture, acoustical properties, and environmental conditions under which the texture will be applied.

**Execution**
Installation shall be in accordance with published standards from United States Gypsum Association and the Portland Cement Plaster Institute.

Installation and location of access panels should be specified to be carefully coordinated with mechanical, electrical, and plumbing equipment coordinated quantities and locations with Facilities. Avoid objects protruding below the plane of ceiling that might interfere with sprinkler head coverage, resulting in violation with NFPA 13.

Above-Ceiling Observation: Before installing gypsum board ceilings, conduct an above-ceiling inspection, and report and correct deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

**FLOORING**

**Specialty Flooring**

**General**
The design and application of specialty flooring is to be selected by the Design Team. Consideration of the use of the space, maintenance requirements of the flooring, and longevity of building must be considered. Materials with short life spans must be avoided. All flooring types should be commercial grade only.

Attic stock shall be specified and provided in quantities as requested by Facilities.

**Products**
Products are to be determined by the Design Team. Products that are strongly discouraged by the University include:

- Bamboo
• Engineered Wood Flooring
• Soft natural stones (i.e. limestone). If soft and/or porous stones are installed, the surface is to be properly treated with a stone impregnator and/or sealed with an appropriate stone sealer to protect from staining. StoneMedic is a preferred line of stone care products. It is recommended that soft and/or porous stones not be utilized in high-traffic areas or in areas where food and/or drink service is common.
• Polished stone.
• Rubber flooring containing mercury.
• Solid white or very light colored flooring due to maintenance issues.

Execution
Floors are to be installed per manufacturer’s recommendations. When adhesives are required, they must be a low to no VOC adhesive.

Resilient Tile

General
The selection of vinyl composition tile (VCT) and rubber base materials shall carefully consider the use of the space. Generally, service corridors and lab environments shall receive VCT. Mechanical and data closets shall receive static dissipative VCT flooring.

Attic stock shall be specified and provided in quantities as requested by Facilities.

Products
Preference is for non-PVC products. VCT is standard 12”x12” tile and must be a minimum of 1/8” thick.

Attic stock shall be specified and provided in quantities as requested by Facilities.

Execution
Installation of VCT shall be carefully coordinated with expansion and control joints in the floor substrate.

Installation of VCT shall be carefully coordinated with adjacent flooring materials, and utilize appropriate transition materials.

VCT will require an approved pattern and layout prior to installation.

VCT shall be installed with low to no VOC adhesives.

VCT is to have a rubber core base. Rubber base must be in rolls unless specialty designer rubber base. No 4-foot long segments are permitted or preformed corner and end pieces. Base should be 4 inches high minimum with a coved depth of ½ inch minimum, unless otherwise approved.

Application of 3-4 coats of a high solids content floor finish (30% or higher) or the use of 3M Vinyl Floor Protector (preferred) is required. If this finish will be applied by SMU Custodial Services, the initial application must be accounted for in the project cost. All finishes for LEED buildings must comply with LEED requirements.
Terrazzo

General
Terrazzo flooring systems should be carefully considered for all main circulation corridors and heavy traffic areas. Use of terrazzo flooring will be dependent upon cost.

Products
Terrazzo flooring systems should be epoxy based, including terrazzo base and stair tread/riser elements.

Divider strips can be either zinc or brass.

Execution
Divider strips and expansion joints in terrazzo patterns are to be carefully reviewed and coordinated with control and expansion joints in the concrete floor slabs.

Carpet

General
The selection of Carpet and rubber base materials shall carefully consider the use of the space and must be Low VOC carpet. Both broadloom and tile products are used throughout campus. Tile is preferred.

- Avoid the use of solid colors for the field and borders, as these do not conceal traffic wear and soiling.
- Avoid the use of solid light colored carpets in high-traffic areas.
- Limit the use of cut pile to private offices.
- Attic stock shall be specified and provided in quantities as requested by Facilities.

Products
The minimum face yarn weight requirement is 20 oz. The minimum traffic class is Commercial 3. Yarn content should be 100% Nylon; no Olefin. The minimum carpet warranty is 15 years, with 1 year for installation. Include a moisture barrier when specifying carpet backing with a minimum 10 warranty.

Attic stock shall be specified and provided in quantities as requested by Facilities

Execution
Installation of Carpet shall be carefully coordinated with expansion and control joints in the floor substrate.

For rolled goods, locate seams only in areas with low traffic, and minimize the number of seams. Carpet installation drawings must be provided to show carpet layout, seams machine direction, and any change of dye lot.

Installation of Carpet shall be carefully coordinated with adjacent flooring materials, and utilize appropriate transition materials.

Carpet shall be installed with low VOC adhesives.
Carpet may either have a carpet base or a rubber base. Rubber base must be in rolls unless specialty designer rubber base. No 4-foot long segments are permitted. Rubber Base may either be cove or a straight base.

When installing carpet in tiered classrooms/auditoriums, carpet shall be installed completely over the edge of the step. Carpet shall not be cut short of the step for the purposes of traction and visibility per ADA guidelines.

Porcelain, Ceramic, and Quarry Tile

General
Tile systems, whether thick/mud set or thin-set, shall carefully consider the use of the space.

Attic stock shall be specified and provided in quantities as requested by Facilities.

Products
- Floor tiles shall be unglazed, porcelain tile or natural stone.
- Wall tiles can be either glazed or unglazed. Tile thickness shall be consistent. Rectified tiles are preferred.
- Grouts shall be of a neutral or gray color for walls and a dark color for floors; grout shall be completely sealed after curing. Light color grouts are not permitted on horizontal surfaces. Grout joints shall align at wall and floor.
- Custom color and special size tiles are to be avoided.
- Grout used on floors and walls should be epoxy type in lieu of regular cementitious grout. When cementitious grout is used, it shall be sealed in accordance with sealant manufacturer’s guidance.
- Attic stock shall be specified and provided in quantities as requested by Facilities.

Execution
The Design Team shall carefully coordinate and select wall and base tile elements that are available in appropriate bull-nose pieces of the same dimensional properties. This is of particular concern at outside corner of wing walls and cove base tiles. Samples of the field tile as well as other shapes (in-corner, out-corner, base, jambs) are required for review and approval. Metal trim solutions for edge protection at wing walls and outside corners are preferred.

Expansion joints in ceramic tile assemblies are to be carefully reviewed and coordinated with control and expansion joints in the wall of floor substrates.

The use of waterproof membranes is required.

When recommended by the tile manufacturer’s written instructions, apply protective coat of neutral protective sealer to completed tile walls and/or floors. All natural stone or porous flooring systems will be required to be sealed with an appropriate sealant or impregnator.
WALL FINISHES

Gypsum Board Partitions

General
The design and application of drywall should carefully consider the use of the space. Thickness of drywall shall be as needed to achieve required UL listing – minimum of 5/8”. Texture shall be “orange peel” applied very lightly.

Wall and corner protection must be provided in public areas. Integral (flush) corner guards (to match the wall paint) or brushed stainless steel – ¼” radius preferred.

Recessed light fixture troughs within gypsum board ceilings over lavatories or water closets are to be avoided.

No paper-faced gypsum board is permitted in restrooms or wet areas. Design Team must specify moisture-resistant glass mat-faced gypsum board.

No paper-faced gypsum board substrates for tile backer board. Design Team must specify cement backer board (complying with ANSI A118.9 and ASTM C 1325, Type A); or water-resistant glass mat-faced gypsum board.

Products
Gypsum drywall products should be packaged in a manner to prevent damage during shipment. Materials should be obtained from the closest source as possible. No paper-faced gypsum board or paper-faced gypsum board substrate for tile backer board is permitted. Design teams must specify glass mat-faced gypsum board, and can use cement backer board or glass mat-faced gypsum board.

Execution
Installation shall be in accordance with published standards from United States Gypsum Association and the Portland Cement Plaster Institute.

Installation and location of access panels shall be carefully coordinated with mechanical, electrical, and plumbing equipment.

Acoustical Treatment

General
The design and application of acoustical panels should carefully consider the use of the space.

Products
Products are to be determined by the Design Team. Partitions and ceilings are to address STC, NRC, and other acoustical performance criteria. STC ratings are to be researched by the Design Team and approved by Facilities as deemed necessary by an Acoustical Engineer.

Acoustical insulation shall be applied to walls of sound conditioned spaces.

Coordination and specifications of acoustical panels shall be by the Acoustical Engineer.

The acoustical provisions shall not diminish fire alarm audibility below code-required minimum level.
Wallcoverings

**General**
Vinyl, Fabric, and Paper wallcoverings are discouraged. Any use of these products must be approved by Facilities.

**Execution**
No wallcoverings on the interior surface of exterior walls.

Paints and Coatings

**Products**
Design Team shall specify manufacturer’s best quality paint material for the various coating types.

Paints and primers shall be either low- or no-VOC.

Paints shall be accompanied by a high build primer, or a skim coat to conceal texture of glass mat-faced gypsum board.

Colors and sheen are to be selected by the Design Team unless otherwise directed by Facilities Project Manager.

Acceptable manufacturers include:

1. PPG Pittsburgh Paints
2. Sherwin Williams

Design Team shall be aware of the use of the space when specifying paint types. A review with the users shall be conducted in order to determine if antimicrobial treatments will have an adverse impact on experiments, chemicals, occupants, etc.

**Execution**
Consideration must be given to painting over existing mechanical, electrical, and plumbing equipment accessories where this will negatively impact its performance.

Painters should protect work and the work of other trades against damage from painting and finishing work.
Custodial Storage (Blue - Highlighted text in this section indicates a requirement. All other items are preferred if budgets permit.)

Space Requirements

Facilities in excess of 4500 square feet:

- Must have one main custodial service room of at least 100 square feet (A)
- One working custodial service room at lease 80 square feet on each additional floor or for each additional 18,000 square feet (B)
- One large storage room at least 150 square feet (C) for storage of larger custodial equipment, and bulk supplies
- One large trash room at least 150 square feet (D) for storage of trash gondolas and staging of trash

Facilities less than 45,000 square feet

- One main custodial service room of at least 100 square feet (A)

Location/Placement (Preferred)

Main custodial service room (A) must be located on the ground floor and in close proximity to a loading dock or service entrance.

Custodial service rooms (B) should be centrally located on a floor.

All custodial rooms are to be dedicated for custodial use and are not to house any building equipment (pumps, water valves, HVAC equipment, electrical panels, telephone panels, fire system panels, or openings to mechanical or plumbing chases, etc.).

Custodial service rooms are not to be located inside other rooms, inside restrooms, on stair landings, or under stairs.

Large storage rooms are to be located off of a loading dock or service area on the ground floor.

Closet Requirements

Main Custodial Closet “A”

- Minimum of 80-100 square feet, with a 7-8 foot minimum width, (square closets are preferred)
- Recessed light fixtures providing 75 fc light operated on a motion sensor switch
- Exhaust fan or other adequate ventilation
- 6 pegs for storage of rotary brushes
- Minimum of 4 hangers for brooms and microfiber mop handles
- Hard surface flooring and walls impervious to water
- Shelving unit 4 feet wide with no less than 4 shelves to accommodate supplies, paper products and storage of liquids in 1 gallon containers
- 36” wide door that swings out
• 24” x 24” x 12” floor basin with proper drain cover
• 1 hot and 2 cold water connections not less than 24” above the floor basin
• 1 cold water connection must have a Y-connector compatible with the standard chemical dispensing units provided by custodial services
• Floor drain immediately outside of the floor basin
• Charging station complete with 3 grounded 20 amp duplex receptacles in open wall space (not behind shelves or near floor basins)

Working Custodial Service Rooms “B” (preferred)
• Minimum of 80 square feet with a 6 ft. minimum width (square closets are preferred)
• Recessed light fixtures providing 75 fc operation on a motion senor switch
• Exhaust fan or other adequate ventilation
• Minimum of 4 hangers for brooms and microfiber mop handles
• Hard surface flooring and walls impervious to water
• Shelving unit 4 feet wide with no less than 4 shelves to accommodate supplies, paper products, and storage of liquids in 1 gallon containers
• 36” wide door that swings out
• One 20 amp grounded duplex receptacle in open wall space

Large Storage Room “C”
• Minimum of 150 square feet with a minimum width of 10 feet, (square closets are preferred)
• Minimum 10’ wide by 3’ deep by 6” high, raised concrete pad for storage of bulk supply items
• Shelving unit 4’ wide with no less that 4 shelves to accommodate bulk supplies and storage of liquids in 1 gallon containers
• 72” wide double door that swings out
• Hard surface flooring and walls impervious to water
• Exhaust fan or other adequate ventilation
• Recessed light fixtures providing 150 fc operated on a motion sensor switch
• Four 20 amp grounded duplex receptacles in open wall space

Large Trash Room “D” (optional)
• Minimum of 150 square feet with 10 foot minimum width
• Recessed light fixtures providing 150 fc operated on a motion sensor
- Exhaust fan or other adequate ventilation
- Hard surface flooring and walls impervious to water
- 72” double-wide door that swings out
- Floor drain with appropriate slope for proper drainage
- One hose bib connection for a standard garden hose (allows for the hosing down of the room)
- There are to be no receptacles available in this room
- Where animal matter is involved, trash storage rooms are to be refrigerated

**Vertical Transportation**
- An elevator should be accessible to the custodial crew in every multistoried building and should land on every floor including the basement/ground floor
- Elevator should contain hard surface flooring.

**Access and Control**
- All custodial closets (A,B,C, and D) should be made accessible via custodial master key
- Access to closets A, C, and D is to be limited to custodial staff only.
- Access to closets B can be made available to building managers in addition to custodial staff.
SPECIALTIES

Visual Display Boards

General
The design and selection of visual display boards should be carefully considered for all teaching and learning spaces. Depending on the project there may be non-traditional teaching spaces that require visual display boards such as lobbies, vestibules, hallways, etc.

Products
LCS magnetic porcelain or equal are required for dry erase marker boards. Glass marker boards are preferred. Minimum trim requirement is metal includes a metal tray for markers and erasers along the entire base of the board. The sizes will be determined by Facilities and End Users. Chalk boards are unacceptable.

Execution
Installation of visual display boards are to be carefully coordinated with the location of light switches and lecture/audio-visual technology podiums. Final locations to be approved by Facilities.

Toilet Compartments

General
Public Restrooms are to take into account the need for toilet compartments and wall mounted polymer (non-rusting) urinal screens.

Layout of the compartments must take into account the sight lines into the restrooms from public corridors, as well as requirements for accessibility.

Products
Toilet Compartments are to be ceiling mounted. Urinal screens are to be wall mounted. Both toilet compartments and urinal screens are to be either stainless steel or solid plastic (HDPE). Color shall be determined in the finish selections determined by the Design Team.

Execution
The Design Team will be responsible for specifying adequate overhead structural support. The partitions shall be full height.

Toilet Accessories

General
The design and selection of the toilet accessories shall be coordinated with Facilities.

Products
Refer to Appendix B-4C.

Paper towel dispensers are to be wall-mounted. Hand towel dispensers shall be Georgia Pacific model 59466.

Hand soap dispensers shall be wall mount model Georgia Pacific Model 52054
Toilet paper dispensers shall be stall or wall-mounted 2-roll either Georgia Pacific Model 56798 or 56782.

Where possible, hand dryers should be utilized in place of paper towel dispensers. Xlerator Automatic, wall-mounted fixed nozzle, 115 volt hand dryers in black or stainless steel or Dyson Airblade V, 115 VAC, are acceptable.

Grab bars are to be stainless steel, and mounted as required to meet current accessibility standards.

**Execution**

Toilet accessory, quantity, type, and selection of toilet accessories to be determined by Facilities.

Refer to appendix B-4C for more detailed description of toilet room accessories.

**Fire Extinguishers and Cabinets**

**Products**

Fire Extinguishers:

- ABC Extinguisher: 5 lb preferred.
- Kitchens with hoods: Provide Class K extinguisher.
- Rooms that contain combustible metals: Provide Class D extinguisher.

All fire extinguishers shall be installed per NFPA 10. Travel distance for the extinguisher will be determined by code. There is no need for identification or signage unless otherwise directed by the University Fire Safety Manager.

All fire extinguisher cabinets shall be:

- Fully recessed
- Non-lockable with vision panel
- Non-breakable glass.
- Cabinets that are located in exterior, moist, or chemical environments shall be stainless steel with breakaway lock.
- Any other details are up to the discretion of the Design Team and Fire Safety Manager.

**Lockers**

**General**

The design and selection of lockers shall be reviewed based upon the programmatic needs of the project.

**Products**

The type and style shall be determined by the Design Team.

Sloping tops are encouraged for non-recessed units. Lockers shall accommodate a user-furnished padlock.

**Bird Deterrent Systems**

**Products**
The University uses Avian Fly-Away System (low voltage electric system).

**Execution**
Facilities shall furnish vendor with a set of the Design Team’s drawings to determine requirements for the bird deterrent system.

The Design Team shall provide power for the system which will be provided and installed by the manufacturer.

Other specialty products and systems required shall be coordinated with Facilities.

**EQUIPMENT**

**Parking Control Gates**

*Products*
Consistent with the campus standard.

Refer to Appendix B-4D.

**Residential Appliances**

**General**
Projects requiring residential grade kitchen appliances shall be designed in collaboration with the University’s Food Services Department, Risk Management and Safety, and Student Affairs through Facilities. Due to manufacturer warranty issues, these residential-grade kitchen appliances should be procured with upgraded warranties that include being installed/used on commercial properties. Note: Some manufacturers deem universities as commercial property and do not warranty appliances used on commercial properties, nor do they differentiate between academic and resident settings.

On campus projects requiring commercial grade kitchen appliances shall be designed in collaboration with the University’s Food Services Department, Risk Management and Safety, and Student Affairs through Facilities.

The Contractor shall provide all appliances, and the Design Team shall provide all electrical and plumbing connections.

*Products*
Washers and Dryers will be furnished and installed by SMU.

All appliances shall be:
- Energy Star rated.
- Contain no CFC or HCFC refrigerant (to maintain LEED point)
- Appliance color options- white, black or stainless steel.
Execution
The Design Team shall specify all mechanical, electrical, and plumbing requirements for equipment at the proper locations.

Foodservice Equipment

General
Projects requiring commercial grade kitchen appliances shall be designed in collaboration Facilities and the End Users. Other departments will be included as required.

The Contractor shall furnish all food service equipment. The Contractor shall receive, unload, and install all food service equipment, and shall provide all utility connections.

Products
The Architect shall retain the services of a Foodservice Equipment Consultant and make recommendations for equipment to be utilized for specific project requirements. The selection of kitchen equipment should include evaluation of the effectiveness of its energy use. When options or alternative approaches offer lower energy use, the lower energy using possibilities should be chosen.

Use of equipment with automatic features should be strongly considered, e.g. auto-fill for reservoirs, automatic shutdown, etc.

Execution
The Design Team shall specify all needs for equipment to the proper location. The Design Team shall also coordinate with Facilities if an exhaust system, and grease hood is to be provided, modified or relocated, and shall make recommendations for type, size, and location as required. Coordinate with local Fire Marshal on Fire Code requirements.

To the greatest extent feasible, all mounting hardware, fasteners, shelving, carts, etc. shall be stainless steel or other non-corroding material.

FURNISHINGS

Window Treatments

General
Window treatments are furnished and installed by the Contractor. The Design Team shall make provisions in the design for in-wall blocking to be provided by the Contractor for the attachment of window treatments.

Products
Horizontal louver blinds or shades are preferred. Shades may be either manual or automatic. If motor operated, Design Team shall ensure proper electrical power and switching provisions have been made.

Blinds shall be made of aluminum or wood. Plastic or faux wood blinds are not permitted. Blinds shall be uniform in appearance from the exterior of the building. Color shall be an appropriate shade of white to fit interior colors. Blinds shall have a nominal slat thickness no less than .0006 of an inch, and a slat width no less than 1 inch.

Roller shades shall have a minimum of 5% light blockage.
Limit use of draperies to specialty areas only. Any fabric window treatments shall be specified as fire retardant/resistant, and submittals shall include evidence of compliance with NFPA-701. This information shall include acceptable test methods and labeling requirements.

**Execution**

Hardware dimensions shall be determined by verified field measurements prior to fabrication and indicated on shop Drawings.

All window treatments shall be installed level and plumb and in accordance with the manufacturer’s written instructions.

The installation shall ensure unencumbered operation of the window sash hardware, if applicable.

For adequate projection viewing where windows or other uncontrolled light sources exist, these sources must be controlled through the use of black-out drapes, shades, or other devices. Provide black-out control for A/V applications, computer labs, and other special areas as determined by end users.

**Millwork**

**Products**

All Millwork shall be low VOC to comply with LEED requirements. All millwork must meet applicable codes and standards. The design team will coordinate plumbing, data, and electrical components with millwork installation.

General Millwork shall be made of plastic laminate or wood veneer to be compatible with intent of interior design. This shall be determined by the Design Team.

Lab Casework shall be made of wood veneer, metal, or solid plastic. The Design Team shall coordinate with the Facilities. The choice of material shall take into account intended use of the space.

**SPECIAL CONSTRUCTION**

As deemed necessary, coordinate with Facilities.

**CONVEYING SYSTEMS**

All buildings containing more than one level shall be equipped with an elevator. The number and locations of elevators shall be carefully coordinated with the specific use of the facility, programming requirements, etc.

**General**

Layout of elevator equipment and equipment machine room shall allow for easy access for maintenance, repairs, and replacement of equipment.

**Products**

Passenger and freight elevators may be hole-less hydraulic or traction type as decided by the design team. Acceptable manufacturers are Otis, Thyssen Krupp, or Kone.

Elevator entrances and doors shall utilize stainless steel materials in directional-brushed finish.
Elevator cab interiors shall utilize durable materials to reduce the amount of annual maintenance costs. The cabs shall be designed to accommodate an emergency stretcher. Adherence of all local, state, and federal codes applicable to elevator installation must be accommodated.

The utilization of non-proprietary control equipment is required.

Elevators restricted to certain floors shall be on the building’s access control system.

**Execution**

The Design Team is to provide code-compliant means for properly disposing of hydraulic fluids. The Design Team is also responsible for providing an alarm when elevator pit sump pump is activated. The Coordination of the alarm location shall be done through Facilities.

A representative from SMU (Owner’s representative) is the only person who can sign final acceptance documents for the elevator from the installer/manufacturer.

The owner must have the equipment re-inspected and recertified if the equipment has been altered, including and alteration made to the interior of the elevator car enclosures or flooring.

Refer to Appendix B-4E.

**FIRE SUPPRESSION SYSTEMS**

**Fire Hydrants**

Where underground water mains and hydrants are required for the building(s) under construction, they shall be installed, completed, and in service prior to combustible construction materials accumulating on site.

**Standpipes**

Where standpipes are required, the standpipes shall be installed when the progress of construction is not more than 35 feet in height above the lowest level of the fire department access. Standpipes shall be provided with fire department hose connections and outlets at accessible locations adjacent to usable stairs.

Standpipes shall be galvanized Sch. 40 pipe.

The standpipe system shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring. Each floor shall be provided with a 2½-inch valve outlet for fire department use.

Where construction height requires installation of a Class III standpipe, fire pumps and water main connections shall be provided to serve the standpipe.

**Area Separation Walls**

When area separation walls are required, the wall construction shall be completed (with all openings protected) immediately after the building is sufficiently weather-protected at the location of the wall(s).
**Fire Sprinkler Systems**

Where automatic fire sprinkler systems are required to be installed in new buildings, the system shall be placed in service as soon possible. Immediately upon the completion of sprinkler pipe installation on each floor level, the piping shall be tested for leaks using compressed air for 24 hours before filling with water and completing hydrostatic testing and inspection.

Dry type sprinkler systems shall have a 6” drip-leg with a moisture trap between the air compressor and the air pressure regulator. The air compressor must be capable of restoring the system back to normal within 30 minutes. Dry type sprinkler systems shall be equipped with cycling type of refrigerated compressed air dryer. Dry type sprinkler systems using galvanized steel pipe shall use an inert gas, e.g. N2, system in lieu of compressed air.

Fire Sprinkler System Piping shall be galvanized Sch. 40 pipe, CPVC, stainless steel, or copper.

After inspection approval from the Fire department, each floor level of sprinkler piping shall be connected to the system supply riser and placed into service. For system activation notification, an exterior alarm bell can be installed and connected to the sprinkler water flow device prior to installation of the monitoring system. All sprinkler control valves shall be locked with a locking device approved by SMU Risk Management, per University insurance guidelines.

For buildings equipped with fire sprinkler systems that are undergoing alterations, the sprinkler system(s) shall remain in service at all times except when system modifications are necessary.

Fire sprinkler systems undergoing modifications shall be red tagged according to university insurers’ guidelines and returned to service at the end of each workday unless otherwise approved by the fire department.

The contractor or his/her designee shall check the sprinkler control valve(s) at the end of each work day to confirm that the system has been restored to service.

**Fire Alarm Systems**

**Maintenance of Existing Systems During Construction**

Fire alarm systems shall be maintained operational at all times during building alterations. When an alteration requires modification to a portion of the fire alarm system, the portion of the system requiring work shall be isolated and the remainder of the system shall be kept in service whenever practical. When it is necessary to shut down an entire fire alarm system, the Contractor shall implement a fire watch or other mitigation approved by the Office of Risk Management until the system is returned to full service.

**New/ Modified Fire Alarm Systems**

General Fire Alarms shall be as indicated in Appendix B-4G.

All fire alarm systems for new and retrofit shall have Voice Evacuation capability. Fire alarm control panels shall be equipped with 3-MODCOM communicator and 120HW surge suppressors on all panels powered by 120VAC.

Fire alarm control panel shall be located at main entry to building, fire control room, or location approved by SMU and local AHJ.

EST3 fire alarm panel shall report to the campus DAR and Fireworks PC, located in police department dispatch center via TCIP connection provided by SMU. During pre-testing and final acceptance testing fire alarm contractor shall have personnel in the police department dispatch center to verify and
acknowledge all events from testing at the Fireworks PC and Digital Alarm Receiver (DAR). Contractors should ensure that events reporting to Fireworks PC give specific building and location information for dispatchers.

All buildings shall have manual pull stations at each exit, with a Stopper II cover and any other location required by SMU, building code, or AHJ.

Construction or retrofit of residence halls and other student living quarters shall require that each living unit be treated as a separate evacuation zone. Room detectors will be fire alarm system detectors without audible bases. All rooms shall be equipped with speaker strobes; speaker only appliances are not acceptable.

Provide interfaces to mechanical, security, elevators, and others systems as required by code or local AHJ. In addition fire alarm system shall have two additional relays for use by SMU energy management system, location of relays to be determined by SMU.

Fire Alarm System Installer Qualifications: System Installer shall be licensed with the State of Texas and shall have been in business for at least 15 years, and have represented the GE Security product line for at least 15 years. Fire Alarm System Installer shall have on staff and in the local DFW area, a full time, employed by bidding firm, Fire Alarm Planning Superintendent licensed by the State of Texas and shall be NICET Level IV Fire Alarm Systems certified.

Any fire alarm technician working on campus shall have a valid Texas Fire Alarm license and shall be factory trained and certified for the respective equipment. Licenses and certifications shall be provided to SMU Risk Management and approved by same, prior to bidding any work for SMU.

**Fire Extinguishers**

Portable fire extinguishers shall be provided and shall be mounted in accordance with NFPA 10. The Contractor shall ensure that an adequate number of individuals are trained in the proper use of portable fire extinguishers.

**Fire Pumps**

Fire pumps shall meet all applicable code requirements. The Design Team shall coordinate with Facilities to see if a fire pump is essential. External air bleed shall be included with the fire pump, as well as a Val-Matic Model 15 air release valve.

Refer to Appendix B-4F for complete description of fire sprinkler systems.
PLUMBING

**Faucets**

Acceptable manual lavatory faucets include Kohler Triton w/lever handles (K-16010-4) and T&S Brass (B-0877 w/010027-40 lever handles). The Design team may select alternate features, e.g., gooseneck spouts, pop-up drains, etc., but the lever handle, grid drain, standard spout arrangement is the preferred arrangement.

Acceptable automatic or touchless faucets include Sloan ETF-610 and EAF 275. All touchless model faucets should be battery operated models in lieu of 120 VAC models. Design team may select other Sloan model touchless faucets. The use of products other than Sloan may be considered on a case by case basis with the approval of the owner.

Acceptable residential kitchen faucets include Kohler (K-7776-K w/K-16012-4 handles) and Elkay model LKD. The Design team may select alternate arrangements to suit specific project requirements and goals.

Acceptable shower faucets include Kohler (K-T6910-4A w/K-304-KS mixing valve) and Symmons Temptrol. For ADA compliant showers, the appropriate spray nozzle w/hose assembly would be specified.

Acceptable commercial kitchen faucets include Kohler Triton and T&S Brass faucets, in configurations appropriate to the application within the discretion of the Design team.

Acceptable janitorial sink faucets include Kohler K-8928 and Chicago, similarly outfitted.

**General notes applying to all faucets:**

All faucets and accessory items are to be bright chrome plated. Design team can make alterations as specific project requirements may dictate.

Lavatory faucets shall have 0.5 GPM flow restrictors.

Kitchen and service sink faucets do not require flow restrictors unless Design team directs otherwise.

When the option exists to select ceramic cartridge design and other features expected to result in longer life/less service, these optional features should be included in the product specified.

**Plumbing Fixtures**

WCs shall be wall mount design, low flush volume (presently 1.28 gal/flush) models of white china construction. Acceptable models include Kohler K-4325 and Sloan ST-2050.

Lavatory sinks shall be wall mount or undermount design. Drop-in construction is not acceptable. These sinks may be china or SS.

Residential kitchen sinks are preferably undermount design. SS sinks may be drop in design. China kitchen sinks may not be drop-in design. Acceptable products are manufactured by Kohler, Elkay, and Just. SS sinks are to be minimum 18 ga. construction.

Urinals shall be waterless design, Kohler models K-4917, K-4918, and K-4919, only. If flush type urinals are to be used, the ultra-low flush volume models are to be used, e.g., Zurn 1/8 gal/flush, etc.
China or porcelain on cast iron construction is acceptable for tubs.

Acceptable construction materials for showers include masonry/tile or fiberglass assemblies (1 to 3 piece construction).

**Plumbing Piping Details**

Waste pipe size shall be no smaller than 1.5”. In the case of lavatory drains, the P-trap and all downstream piping is to be a minimum of 1.5”. The typical 1.25”lavatory tailpiece drain will be connected to the 1.5” P-trap by use of a 1.5”/1.25” adapter washer in the P-trap entry.

Stop valves for lavatory/kitchen sinks, WCs, ice machines, and other appliances shall be Maguire H-2165-BV, or equal. This valve configuration -0.5”NPT x 3/8” compression – is to be maintained. The use of loose key stops is not acceptable unless specifically indicated in project drawings/documents.

Flexible risers with SS overbraid are acceptable.

WC plumbing batteries shall have elevated clean out(s) accessible from the RR.

In RRs, provide a wall box mounted 0.5” hose bibb near the lavatory battery. This hose bibb to have loose key operated valve. Wall box w/cover should be SS similar to Woodford model MB 67.

Acceptable flush valves are Sloan, Regal, Royal, or Naval (for grey water application). When automatic action is required, use the Optima G2 top mount actuator or the EBV89 side mount actuator. All actuators to be battery operated in lieu of 120 VAC. Alternate brands of flush valves are not acceptable.

Acceptable shower drain fittings shall use a receptor base threaded from the top, similar to Oatey model 42045. Fittings with attaching nut accessed from below shower pan are not acceptable.

P-traps for lavatories, residential kitchen sinks, and other small fixtures shall be chrome plated cast brass, 17 ga., or better, similar to Maguire B 8912 C, or equal.

All pipe, valves, and fittings in contact with potable water shall be brass, bronze, SS, or other non-corroding materials. NSF approved epoxy lined cast iron devices are acceptable. Brass/bronze products shall be no/low lead formulations, as required by plumbing code. Use of galvanized steel components is not acceptable.

Acceptable piping material for potable water service includes copper, type L, or heavier, SS tubing, Sch. 10 or heavier, PVC, CPVC, and other code approved plastic materials. Note, SMU does not allow PEX and similar plastic tubing for potable water service inside buildings. PVC for small (2.5” and smaller) pipe inside buildings is discouraged.

Acceptable piping materials for waste/drain/vent applications include copper tubing, type L or heavier, PVC, CPVC, cast iron, galvanized steel, Sch. 40 or heavier. Other materials will be considered by the Design team and owner as project needs may direct.

Acceptable methods of joining piping for potable water service includes sweat (no lead solder), brazed, threaded, flanged, solvent weld, compression, grooved joint. Pro-Press is not allowed in UP. Pro-Press is acceptable for potable water service where allowed by local plumbing code. Other joining methods will be considered by the Design team and owner as project needs may direct. Push to connect fittings (e.g., Shark bite, etc.) are not acceptable.
Acceptable methods of joining waste/drain/vent piping includes sweat, brazed, threaded, flanged, solvent weld, compression, heavy duty No-Hub (4 clamps per connector ILO 2 clamps), MG couplings, Tye-Seal, groove end fittings, mechanical joints. Other joining methods will be considered by the Design team and owner as needs of a project may direct.

**Special note** - For underground piping, acceptable methods of joining pipe include sweat, brazed, flanged, solvent weld, mechanical joints, groove end, and repair coupling. No-Hub type connectors are specifically prohibited in any underground application.

The use of Trap Guard, or similar product, for drain traps is preferred. The use of mechanical trap primers is discouraged unless required by local plumbing AHJ.

Dielectric nipples shall be used in lieu of dielectric unions.

The use of auto vents (e.g., Studor valves) on waste/drain piping is not permitted, per UP plumbing code.

Garbage disposers in residential kitchen and other non-commercial kitchen applications shall be as a minimum 0.5 HP Insinkerator, or equal.

Isolation valves shall have bronze bodies with full port/SS trim for pipe sizes 2” and smaller, Nibco fig. T-585-70-66.

**Special note** All valve connections 2” and smaller shall be threaded, flanged, compression. The use of solder end valves is not acceptable. For isolation valves 2.5” and larger, the use of butterfly or gate valves is acceptable. Valves 2.5” and larger maybe flanged or groove end. The use of threaded or solder/braze connections is not acceptable for valves of this size. Brass/bronze valves shall meet the requirements of the plumbing code for no/low lead composition. The use of NSF approved epoxy lined cast iron valves is acceptable.

Acceptable pipe insulation systems for cold service pipe, subject to condensation, is preferred to be elastomeric foam (e.g., Armaflex, etc.). Other acceptable materials include Foam-Glas, urethane foam, Owens-Corning Vapor Wick. Plain fiberglass is not acceptable for cold service piping.

Acceptable pipe insulation for hot service piping include fiberglass, elastomeric foam, Foam-Glas, urethane foam.

Acceptable pipe jacketing for insulated piping includes PVC for interior locations, aluminum jacket for exterior locations and regions subject to mechanical abrasion. Acceptable underground insulation systems includes Foam-Glas w/Pitt wrap, pre-insulated pipe systems. Design team may consider other systems for underground application as project criteria dictate.

Acceptable methods to provide domestic hot water delivery include recirculation loops and heat tracing. For recirculation loops, piping shall be run in a reverse return configuration. The use of automatic flow control valves e.g., Griswold, AutoFlow, etc., is acceptable. The use of manually positioned valves, e.g., circuit setter, etc. is not acceptable. For heat traced systems, self-limiting heat tracing tape shall be used with integral temperature control sensing and switching.

All hangers, brackets, supports, etc. to support pipes, valves, conduits, etc. must be hot dipped galvanized, or better. Fasteners (nuts, bolts, washers, etc.) and all-thread rod shall be SS, or better.
Plumbing Valves

Acceptable valves in plumbing applications include-

Bronze body ball valves (full port, SS trim), 2” & smaller. Nibco fig T-585-79-66, or equal.

Butterfly valves (lug body, aluminum bronze or SS disk w/gear operator), 2.5” & larger. Nibco LD-2000, or equal.

Non-slam check valves (bronze/brass body, resilient seat), 2” & smaller. Nibco fig. T-480-Y, or equal. For valve sizes 2.5” & larger, Nibco fig. W 910-W, or equal.

Gate valves, 2” & smaller, all bronze, threaded, rising stem. Nibco T-124, or equal. 2.5” & larger Kennedy model C515 epoxy coated valves, or equal.

Acceptable RZBP valves, sizes 2” & smaller shall be Watts series 909. Sizes 2.5” and larger series 909RPDA. Other series of RZBP may be considered for the sizes larger than 2.5”. In all cases, the isolation valves supplied with the RZBP shall be of the rotary design (ball, butterfly, etc.) ILO OS&Y or NRS gate type valves. In the case of specific requirements by code, the AHJ may stipulate the use of OS&Y valves or other configurations. Code compliance will take precedence over the Design Guideline. Alternate RZBP products by Conbraco (T 2) and Febco may be considered. Special note RZBP valve must be positioned within 5’ AFF to facilitate periodic testing/certification.

Groove end valves, when used, shall have non-ferrous disk and extended neck. Plated disk or encapsulated disk construction is not acceptable. Extended neck is necessary for all applications which involve insulated pipe.

Special Plumbing and Piping Systems

Acceptable electric drinking water fountains (EWCs) include Halsey Taylor, Oasis, or equal. EWCs shall include optional water bottle filler.

Acceptable piping for lab/acid waste service is glass pipe, Kimax or equal.

Acceptable materials for high purity water service include Sch. 80 PVC, solvent weld, for reagent grade water. For higher grade pure water systems, PVDF with thermal welded or mechanical joints is acceptable. High purity water systems must be designed with minimum 5 ft/sec recirculation fluid velocity, continuous UV biocidal treatment, filtration to minimum 0.1 micron values, and minimal length of distribution piping with stagnant flow conditions.

Acceptable practice for storm/sanitary sump piping includes non-slam design, resilient seat check valves and rotary design, full port or butterfly isolation valves, located outside of sump.

All below grade walls of buildings and other structures shall have a perimeter drainage system, unless geotechnical analysis advises otherwise. When installed, the perimeter foundation drain systems must comply with the design as described in Appendix B-4H.

Domestic water heaters operating on steam shall be as selected by the Design team. For applications involving gas fired water heaters, the model selected shall be Lochinvar or other manufacturer at the discretion of the Design team.
In commercial kitchens, constant water flow operations shall not be used. For example, the water sluice to garbage disposer shall use solenoid valves or other automatic method to flow water when needed ILO continuous flow. Once through cooling for DX refrigeration, etc. are not allowed.

**Sumps – Sanitary and Storm**

Storm and sanitary sump covers shall be constructed of aluminum plate (1st choice) or galvanized steel plate. Plain/painted carbon steel is not acceptable. All attaching/mounting fasteners shall be SS.

Storm sump covers are not required to be gas tight unless the Design team directs.

All isolation valves for all sump pumps must be accessible from outside the sump. For pipe sizes 2” & smaller, the full port, SS trim ball valve is to be used. For sizes 2.5” & larger, butterfly valves shall be used. If solids are present in the pumped stream, segmented ball type valves are to be used, e.g., Val-Matic or Pratt. The check valves must be non-slam design, e.g. Nibco fig. T-480-Y (2” & smaller), fig. W-910-W (2.5” & larger). The Design team will advise use of fully lined check valves, e.g., Tideflex by Red Valve, for services involving solids in the pumped stream ILO swing check design valves. Whenever swing check valves are used, each shall be equipped with external weight and dashpot assembly.

For submersible pumps whose weight exceeds 70 lbs, a pump withdrawal system shall be employed, e.g., Weil model 2613. The guide rails for such systems must be stainless steel, or better. All fasteners, brackets, inserts, chains, and related hardware within the sump must be SS, or better.

**MECHANICAL EQUIPMENT AND SYSTEMS**

**HVAC EQUIPMENT AND DESIGN CRITERIA**

HVAC system design is to trend toward the use of fewer parts to accomplish design goals. To this end, central station AHU designs should be used ILO distributed design systems such as fan coil units, induction systems, DX systems, etc.

AHUs (DX and chilled water), capacity 2500 CFM and larger, shall have UV lamps irradiating the cooling coil(s). UV fixtures shall use 36” lamps, G3OT8. Access door into AHU cabinet shall have safety switch to deactivate UV lights when door is open. UL light system shall have local toggle switch as well as a 7 day timer to control the UV lights. UV fixtures shall be designed to provide a minimum of 1.4 watts/sq. inch of coil face area (use one G3OT8 lamp/4 sq. ft.). Max. spacing between rows of fixtures is 20” and the space between fixtures and coil face is to be 7” to 15”

Cooling coils shall be selected with maximum 500 FPM coil face air velocity. 44 F is the design chilled water supply temperature.

AHUs with mixed air temperatures below 45 F shall employ pre-heat coils. Steam is the preferred media for pre-heat service. Every AHU with outside air capability shall have 2 freezestats, one manually resettable, one resettable through the BAS.
All chilled water cooling coils shall have the following features - SS casings, supports, fasteners, etc., non-ferrous coil runout connections (red brass or similar non-rusting materials), SS drain pans, coil vent/drain connections extended through cabinet (use SS nipples) w/ball valve termination.

Filter racks shall be gasketed to reduce bypass air volume.

All AHUs (2500 CFM and larger) shall have full economizer cycle capability.

When selecting fans for HVAC and exhaust applications, every effort should be made to select a direct drive fan, e.g., Fanwall, single or multiple direct drive plug fans, etc. The major criteria for fan selection include efficiency, low noise, stable operation throughout speed range, and reliability. If a belt drive selection is made, the optional V-belt tensioner is to be included.

AHU systems sizes 5000 CFM and larger are to include RA fan, dampers for RA, OA, and relief air. Individually controlled damper sets shall be used. The AHU cabinets shall be rated for a minimum of 6” H2O.

Preferred air filter arrangement in AHUs is pre-filter w/MERV 8 filters followed by main filters rated MERV 13. Design team may increase filter ratings as deemed appropriate.

All air control dampers shall be opposed blade design; deviations from this policy require specific owner’s approval in writing. Damper operators shall be Belimo or Siemens; deviations require owner’s written approval.

Use of pneumatic controls for building HVAC systems is not acceptable.

**HVAC SYSTEM DESIGN CRITERIA**

Preferred HVAC terminal unit configurations include VAV box w/wo reheat, parallel fan powered VAV box w/wo reheat.

HVAC energy management & control system shall be BACNET open system protocol. Approved supplier is Siemens.

The use of fiberglass thermal/acoustic insulation in supply air duct and equipment is not acceptable. Supply air must not contact fiberglass. Acceptable thermal/acoustic insulation products include fiberglass faced w/Mylar or aluminum foil, elastomeric foam (Armaflex, etc.), double wall construction, cotton fiber, and other materials which the Design team may select. Acoustic treatments could be made using sound attenuators, resonators, source reduction, etc.

Outside air intake(s) should be locate as high above ground level as possible. Below grade air inlets are not acceptable.

Fire/smoke dampers shall have electric actuators by Belimo. Honeywell actuators are not acceptable. Pneumatic actuators are not acceptable.

All AHUs, fan coil units, VAV boxes, ducts, and other HVAC equipment shall be constructed and insulated such that no surface condensation will occur when internal temperatures are 44 F dry bulb and external conditions are 100 F dry bulb @ 78 F wet bulb.

All motors 1 HP and larger, on fans or pumps shall have sealed bearings.
HVAC sheet metal duct shall be built in compliance with the current SMACNA standards.

All ducts which have been made obsolete and are out of service shall be removed. No duct work is to be abandoned in place. The point of connection to active ducts will be sealed with metal and made leak tight and water proof. Any ducts which are taken out of service temporarily shall have all openings closed/sealed with minimum 1 mil plastic sheet or heavier.

Ducts handling moist/wet air e.g., RR exhaust, kitchen exhaust, natatorium exhaust, etc. shall be made of aluminum or SS, as appropriate in the judgment of the Design team.

Material selection for lab and process exhaust ducts shall be made in consultation between Design team and Facilities staff.

HVAC ducts shall typically be metal duct with external thermal insulation. Use of fiberglass ductboard is specifically disallowed in all supply and air transfer applications. Internally lined duct may only be used in return air applications with owner’s written approval.

Humidifiers should be used only after all alternatives have been considered. For small size applications, electric canister type steam generators should be considered. Process steam may not be used to directly humidify areas. Nortec canister type humidifiers are to be used for these smaller size applications.

When steam-to-steam generators are used, the design shall provide for softened or otherwise treated make up water for the generator (to prevent scaling) and the humidifier body/grid & steam supply piping made of non-corroding materials – SS, copper tubing, etc. The use of plain carbon steel or cast iron is not acceptable for humidifier steam unless reliable deaeration of the makeup water has been achieved.

Interior regions of buildings should be designed as “cooling only” zones, minimize the occurrence of spaces with interior and exterior exposures.

All HVAC equipment must be located with adequate service access. This includes adequate size and location of access doors into regions of restricted accessibility, e.g., ceilings, minimum 3’ clearances around AHU cabinet doors and hatches, 3’ clearance in front of control and electrical enclosures, etc.

HVAC equipment located above ceiling shall have P-touch or similar labeling attached to grid or access doors indicating/describing the equipment above.

All chilled water control valves shall typically be 2-way design when chilled water pump has VFD or otherwise operates in variable flow mode. 3-way valves may be used ILO bypass valves to maintain flow to hydraulic extremities of hydronic circuits.

SMU will contract with a Testing & Balance contractor to provide T&B services. The T&B vendor may be retained early in the project design phase. He will be consulted about the location of pressure and temperature sensors as well as optimal flow meter locations.

Occupancy sensors, when deployed, will be used to toggle the BAS between “occupied” and “unoccupied” modes in each room (zone). This control strategy is to be implemented in all new and existing spaces.

Refer to Appendix B 4J for more detailed description of AHUs.
BUILDING DESIGN CONSIDERATIONS

Typical acceptable room temperature range in campus spaces for cooling is 72 – 76 degrees F and for heating 68 – 72 degrees F.

Each classroom, meeting room, conference room, residential suite, and laboratory shall have at least one thermostat to regulate temperature within the space. With regard to offices and other single occupancy spaces, as many as 3 offices may be served by one zone (thermostat) when the offices are approximately the same size and have the same exposure. Corner offices shall have a thermostat, in any event.

Any room housing electrical, A/V, telecom, elevator, or other continuously operating equipment shall have dedicated cooling. This may be in the form of a chilled water fan coil unit or a small DX system. Typically these types of spaces will not require heating.

Building envelop insulation values shall have minimums of R-30 below flat roofs, R-40 below attics, R-15 in walls above grade, & R-5 in walls below grade.

Illumination levels shall be as high as achievable with power usage at 1 to 1.2 watts/sq. ft.

VFDs and hydronic loop differential pressure values will be used to control hydronic water flow rates within building systems.

IT contractor will provide 3 Ethernet connections for BAS. The locations will be coordinated with controls vendor (Siemens) during construction phase. These connections will serve routers for BAS & lighting controls and the building electrical meter.

SMU will contract directly for building commissioning services. Commissioning agent will be select early in the project design phase in order to be able to fully participate in the optimization of the project design.

Any renovations in which re-purposing of spaces is planned, the Facilities Planning & Management Group must be involved at the earliest possible point in order to properly assess the effects of proposed changes on the mechanical, electrical, and plumbing systems in the involved section(s) of the building. Of special consideration are changes involving HVAC and electrical systems.

The design of new and remodeled spaces shall include evaluation of the designs with regard to the relevant ASHRAE and IBC standards. Included but not limited to this list are ASHRAE 90.1, 90.2, 189.1 189.2, 62.1, 62.2, and 55. All of these referred to the most recent edition of the standard published. The current editions of the IBC, IEC, IMC, and IPC shall be complied with.

The strategy to condition rest rooms is to exhaust air from the rest room. No supply air will be ducted into these spaces. Rather, ambient air from adjacent occupied spaces will be drawn into the rest rooms via transfer ducts, open passage ways, or transfer grilles. For small buildings which have limited or no adjacent conditioned spaces, spot heating and cooling measures can be used as deemed appropriate by the Design team. For large RRs, a two level ventilation approach is to be considered. Specifically, minimum exhaust volume is maintained when building is in “occupied” mode. Occupancy sensor will be used to increase exhaust volume during times of actual usage. A VAV box with 2 position actuator shall be used to achieve the high and low volume air flows. T&B will establish the settings of the VAV box to achieve the two air volumes.
MECHANICAL AND ELECTRICAL ROOM DESIGN REQUIREMENTS

Arrangement of equipment, piping, ducts, etc. within technical spaces shall be developed to provide the necessary amount of space to inspect, service, and repair the equipment therein. This includes the provision of access pathways to the technical spaces through the building or from the exterior. Consideration must be given to movement of equipment and components which while having significant weight and unwieldy dimensions are frequently relatively fragile and subject to damage.

Doors/hatches on AHUs cabinets must not be blocked by placement near columns, pits, piping, or other significant obstacles to operating the door and entering the AHU.

GENERAL MECHANICAL SYSTEM REQUIREMENTS

Thermal Insulation Systems

For piping applications in cold service, inside buildings, SMU stipulates that one of the following thermal insulation systems be used -

- Owens-Corning Vapor Wick
- Elastomeric foam, e.g., Armaflex, Aeroflex, etc.
- Foam-Glas
- Urethane foam

Jacketing may be applied as determined by the Design team. PVC jacketing is appropriate to improve the appearance of exposed piping, excluding Vapor-Wick which includes PVC jacketing. Aluminum or SS jacketing may be used for piping exposed to mechanical damage or exterior environments. For underground applications, Foam-Glas w/ Pitt Wrap or pre-insulated pipe systems may be used.

For piping applications in hot service, inside buildings, SMU stipulates that one of the following thermal insulation systems be used –

- Fiberglass
- Foam-Glas
- Urethane foam
- Elastomeric foam, e.g., Armaflex, Aeroflex, etc.
- Mineral wool
- Calcium silicate
- Pre-insulated pipe system

The Design team will select the most appropriate product for the application. Each of the identified systems has specific temperature limits which must be considered. Jacketing selection is similar to that for cold service applications along with consideration of expected temperature limits.
The thickness of the selected insulation system will be determined by the Design team in compliance with the applicable codes and good insulation practices. In the case of insulating the storm, drain, and waste lines, the goal is to prevent condensation rather than energy conservation. The insulation thickness to prevent condensation is expected to be somewhat less than that needed to comply with energy code requirements.

Special note - storm, waste, and drain lines receiving cold water must be insulated for the entire extent of the pipes within the building.

Compliance with all standard practices for good insulation installation is expected. This includes implementing measures to prevent crushing insulation at support points, maintaining vapor barrier integrity, not using staples in ASJ, etc.

Steam traps shall be Armstrong or Spirax Sarco inverted bucket traps for non-modulating steam pressure applications and float & thermostatic traps for modulating steam pressure applications.

Building hydronic convertors shall have copper or SS tubes, non-ferrous/SS tubesheet, and flanged inlet/outlet connections.

Steam systems shall be designed to avoid the need for pressure regulators and relief valves. Minimum design pressure rating for all components of the steam system shall be 125 PSIG. Should pressure regulators be needed, the use of Spence model D valves w/type E pilot, Spirax Sarco 25 P are acceptable. For small volume steam applications, the Design team will select an appropriate model from Spirax Sarco, Cash-Acme, or owner approved equal.

Steam condensate piping placed in utility tunnels, exterior locations, or direct bury locations shall be SS 304, Sch. 40, or better. All connections shall be welded or flanged. Condensate piping inside buildings shall be carbon steel, Sch. 80, or better. Steam pipe in all locations shall be carbon steel, Sch. 40.

Steam pipes in distribution services shall have a drip trap assembly installed every 200 feet of horizontal runs, at every vertical rise in steam pipe run, and before each steam pressure regulator/control valve. The typical arrangement of the drip trap assembly is for the “dirt leg” to be 2” in diameter or the same size as the distribution pipe whichever is larger and have a minimum vertical length of 12”. Steam trap is to be of inverted bucket design with connection size ¾”. Ball type isolation valves are to be used ILO gate type valves. Special note – all ball valves 2” and smaller are to be full port w/SS trim, e.g., Nibco T-585-70-66, or equal. Y-strainer shall be provided to protect the steam trap. Include provision for vent/drain shall be via ¼” ball valve.

Expansion joints used in steam service shall be of the self-equalizing design, equivalent to Adsco Corruflex equalizing expansion joints.

Hydronic pumps are to be vertical in-line design models for flowrates 500 gpm and lower.

Inertia bases for pumps and fans will not be included in project designs unless specifically requested by the Design team.

Hydronic chilled water pump installations shall include a bypass pipe with non-slam check valve w/isolation valves.
All hydronic pumps, heating and chilled water services, shall be equipped with VFDs unless specifically excluded by Design team.

The installation of all hydronic service pumps will include isolation valves, non-slam check valves where indicated, and 5 pipe diameters of straight inlet and discharge piping. The use of flow straightening fittings may be used to reduce the amount of straight pipe lengths.

Potable water make-up to hydronic systems shall have an RZBP backflow preventer and it shall be placed within 5’ AFF.

Hydronic heating systems and process cooling systems shall be equipped with pot feeders to inject water treatment chemicals, corrosion inhibitors, etc. Note, this does not apply to campus hydronic chilled water systems which receive treatment through the central plant.

Water containing hydronic equipment (pumps, HTX, tanks, etc.) shall be located within a water containing barrier (either concrete or galvanized steel) with minimum 3” height. The water retaining regions within these barriers shall be waterproofed with a coating equal to Jaxsan acrylic polymer. All floor penetrations within these barriers shall also be sealed to prevent water passage to lower floors.

All hangers, brackets, and all related hardware used to support pipe, conduit, ducts, valves, etc. shall be hot dipped galvanized, or better. Fasteners (nuts, bolts, washers, etc.) and all-thread rods shall be SS, or better. This applies to all locations, interior, exterior, crawl spaces, etc.

Electric motors 20 HP and larger served by VFDs shall have static electricity control system equal to Aegis.

Campus standard VFD is the Siemens BT 300. No substitutions acceptable without owner’s written acknowledgement. Refer to Appendix B-2F for SMU’s Renovation IAQ Protocols.

Refer to Appendix B-2F for SMU’s new construction IAQ protocols.

Refer to Appendix B-2F for SMU’s Renovation IAQ Protocols.

**ENERGY MANAGEMENT SYSTEM**

The building automation system (BAS) shall be coordinated with the project MEP systems design and implementation through the project Design team. The GC shall ensure that all related Appendices (B4-L through B-4P) are provided to approved vendors as part of the bid proposal for the project. SMU has standardized on the use of Siemens for the BAS. Nevertheless, the bidder must comply with the provisions of the BAS Technical Compliance Check List and BAS Metering and Energy Auditing Compliance. All these documents comprise a complete successful proposal.

Refer to Appendix B4-L for SMU BAS Controls Specification, new construction.
LIGHTING CONTROL SYSTEM

Each new construction and major remodeling project shall incorporate a solution for the control of lighting systems of a building, exterior as well as interior lighting. The lighting controls may be an integral part of the BAS or other vendors’ lighting control systems. Any lighting control system must be fully integrated with the Siemens BAS such that commands, monitoring, and management of the lighting control system can be accomplished through the Siemens BAS. Owner must have written assurance of this capability before a proposal can be considered.

The lighting control system shall manage electrical consumption by the use of daylight harvesting, occupancy sensors, scheduling w/local override switches, and other strategies to minimize the electrical consumption of the lighting functions. One lighting controller will be provided per lighting breaker panel to facilitate this action.

ELECTRICAL SYSTEM

General Design Requirements

All electrical conductors, cables, busses, and other current carrying components shall be copper. Lugs, clamps, and terminals of all types shall be brass/bronze. Fasteners used in terminals, clamps, etc. shall be SS, brass, or other non-corroding material as appropriate. Aluminum alloy components and conductors may only be used with owner’s written approval. Substitution requests must be made in a timely manner to prevent forced selection of particular material(s).

The use of color coding tape is acceptable on large conductors (8 ga. and larger). For conductors 10 ga and smaller color tape is not acceptable.

Use of armored cable (type AC), metal clad cable (type MC or MC lite), non-metallic sheathed cable (types NM or NMC), shielded non-metallic sheathed cable (type SNM), service entrance cable (type SE & USE), and underground feeder cable (type UF) is not acceptable unless the owner’s specific written approval is issued.

Flexible metallic conductors, e.g., MC cable, shall be limited to lengths of 6’ within accessible areas e.g., accessible ceiling plenums, appliance whips, and similar applications. In no case shall MC cable be deployed inside walls, below floors, or above monolithic ceilings. In special circumstances, owner may consider use of flexible metallic conductors, but owner’s written approval must be obtained.

For new buildings and major remodel projects, a complete over-current protective device coordination study shall be performed. A written copy of the study along with the electronic file will be provided to the owner as soon as the study is completed and implemented.

One conduit transition (PVC to metal, etc.) is acceptable in each conduit run. A conduit run is defined as a length of conduit between two pull boxes, junction boxes, or terminal enclosures.

Preassembled modular raceway/conductor assemblies are not acceptable unless specifically approved for a project. Minimum acceptable size/arrangement of integral conductors is 12 ga/3 conductors. Specialized conductors, e.g., MV, signal cabling, fire protection, communication, etc., shall be specified in construction documents (drawings and specifications).

Neutral reduction is not acceptable. Any exception must have owner’s written approval.
Common neutrals are not acceptable.

All raceways shall contain a separate grounding conductor.

The use of compression couplings to join conduit is strongly preferred. Set screw couplings may be used for conduit sizes 2” and larger.

Underground raceways, conduits, etc. shall have minimum of 24” of earth cover. Install magnetic tracing tape/wire 12” above the conduits.

Underground raceways shall be in PVC.

Electrical contractors shall be required to follow current TDLR requirements for staffing jobs, specifically, the stipulated ratio of the number of journeymen to apprentices on a job. All electricians on projects shall have TDLR licenses.

**LIGHT FIXTURES AND INSTALLATION**

Light sources and fixtures shall be chosen to minimize the number of different types and sizes within a project. The lamp types and wattages should be selected for maximum lighting effectiveness and efficiency. Unless otherwise specified, light fixtures will utilize florescent lamps, T-8 energy saver, 4100 K w/electronic ballasts.

Exit fixtures shall use LED lamps w/self-testing battery/charger, e.g., Bodine Redi-Test, or equal.

When considering fixtures using MR12/16 lamps, the use of LED versions of these lamps shall be used.

All light fixtures shall have separate ground conductors. Integral grounding in lumenaires is not acceptable.

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**Common Lamps Used on Campus**

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<tr>
<th>Wattage</th>
<th>Length</th>
<th>Type</th>
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<tr>
<td>28 watt</td>
<td>4 foot</td>
<td>T-8, 41K</td>
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<tr>
<td>28watt</td>
<td>2 foot</td>
<td>T-8, 41K</td>
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Occupancy sensors shall be used wherever feasible. Also, the use of 2 level light switching circuitry should be considered. The Design team will evaluate the cost/benefit ratio to determine if the 2 level switching feature is feasible.

For small size rooms where a single wall or ceiling mounted sensor is appropriate, Wattstopper models PW-100 or 200 or UW-100 or 200 are acceptable. If use of dual technology sensors is indicated, the model DW 100 or 200 is acceptable (for wall mount sensors).

For larger spaces, ceiling mount sensors will probably be the better choice. Wattstopper model DT 200 or 300 are suggested for consideration.

Note- the given Wattstopper model #s may have been superseded since these Guidelines were published. The electrical sub should submit alternate model numbers for Wattstopper products when newer designs are available. SMU is standardizing on the use of Wattstopper products but will consider other brands of equivalent or better performance.

For recessed can type light fixtures located in monolithic ceilings (gypsum board, plaster, etc.), these fixtures must be of a design and configuration which will allow servicing and replacement of components (ballast, batteries, etc.) from below the ceiling without exposing the electrician to dangerous levels of power. Acceptable measures include installing adjacent access door/panel, selecting fixture models which allow the energized parts to be safely withdrawn through the fixture aperture in the ceiling. The Design team will consider other methods proposed to accomplish the stated purpose of safely servicing the fixtures.

Light fixtures in large occupancy spaces, e.g., auditoriums, Coliseum, etc., shall be made accessible for service/repair by catwalks, attic access, retractable fixture system, or other measures as may be proposed. In all cases, the need to use multi-story scaffolding, extraordinary man lifts, and similar alternatives to access light fixtures must be avoided.

Lighting of cupolas presents specialized challenges to service and maintain. The selection and placement of light fixtures must be made with full consideration of the difficulty to keep the cupola lights operating.

Interior lighting control systems may be utilized to better manage lighting energy use. Any lighting control system must be compatible with the BAS (Siemens) serving the building.

Interior exit light fixtures shall be as manufactured by Cooper Industries, Sure-Lite model EUR, or owner approved alternate. All self-powered emergency light fixtures shall include self-testing battery/charger feature. See submittal information in Appendix B-4T.

**EXTERIOR LIGHTING**

All exterior light sources shall have a long service life, e.g., LED, induction, etc.

Control of exterior light fixtures shall be via the BAS if at all feasible. When BAS control is not feasible, a regional light control strategy shall be used ILO multiple sensors (one photo-electric eye/fixture, etc.). The use of accessible photo-electric eyes is preferred to the use of time clocks.

For strings of exterior light fixtures, the highest voltage electrical service used shall be 208 VAC ILO 277 VAC. 277 VAC power may be used for exterior lights if all electrical junctions can be made in above ground locations (e.g., within the light pole cavity, etc. If underground junction boxes are involved, the use of 277 VAC is not acceptable. Multiple circuits shall be used to power strings of exterior fixtures ILO single circuit serving continuous group of fixtures. This measure is to ensure that when a circuit opens, a portion of the fixtures in each area will remain lit.
All hardware, fasteners, etc. used on exterior fixtures and their mountings shall be SS or other non-corroding material.

All step lights, foot lights, and fountain light sources shall be LED. The Design team will determine the utility of color change and other options when employing LED lighting.

Light fixtures at high elevation on building entrances shall be accessible from inside the building if possible, e.g. attics, technical spaces, etc.

**MOUNTING AND INSTALLATION DETAILS**

All metal hangers, mounting straps, struts, brackets, and related materials used to hang, support, or locate electrical fixtures, conduits, junction boxes, etc. shall be hot dipped galvanized, or better.

All fasteners, nuts, bolts, washers, screws, etc. used to mount, attach, or install electrical equipment, light fixtures, enclosures, etc. shall be SS, or better.

All electrical hardware placed in exterior locations, crawl spaces, utility tunnels, kitchens, labs, and all other moist environments shall be cast aluminum, SS, or better. Conduit and related connectors, fittings, etc. shall be aluminum, PVC coated metal, PVC, or other corrosion resistant material, consistent with the applicable electrical codes.

**ELECTRIC MOTORS**

All electric motors larger than 2 HP shall be premium efficiency and rated for VFD service if served by a VFD. These motors are to have sealed bearings ILO re-greasable bearings.

Electric motors 20 HP and larger, served by VFDs shall have a static electricity control system, e.g., Aegis, or equal.

All motor lead connections shall be made using mechanical connectors. Acceptable methods include split bolt clamps (Kearney, etc.), ring terminals w/nut & bolt, etc.

To the extent feasible, direct connected rotating equipment designs should be selected ILO a device with mechanical coupling connecting motor to driven shaft. Examples include using close coupled design motor/pump ILO coupled design; select direct drive fan models ILO V-belt driven fans.

For equipment with V-belt drive, optional V-belt tensioners should be provided with the equipment.

**ELECTRICAL DISTRIBUTION PANELS and SWITCHBOARDS**

Power distribution panels shall have copper bus and bolt on breaker design. All single pole 20 A breakers shall be “switch duty” rated.

All connections in electrical panels and enclosures shall be torqued to manufacturer’s specifications. Fasteners shall be marked by installer as fasteners are torqued to spec.
All panel legends shall have a complete description of the location and type of load each breaker is serving. For example, breaker #4 serves outlets in Rm. 120, breaker #34 serves lights in Rm. 236, etc. Generic description of type of load with no room location is completely unacceptable.

**ELECTRICAL COMPONENTS AND INSTALLATION**

Outlet and switch boxes shall be a minimum of 4”x2”x2 1/8”.

All wire shall be stranded.

Receptacles shall be “pigtailed”.

120 VAC power shall be provided to each control enclosure located at final control elements, e.g., VAV box controllers, equipment with self-contained electrical control enclosures, etc. A disconnect switch is to be provided at each such power drop. Transformers and circuit protection (in-line fuse, integral breaker, etc.) to be provided by controls vendor or the equipment manufacturer.

**TRANSFORMERS and VAULTS**

Owner’s Design team will approve all transformer selections and evaluate all product submittals.

All vaults shall have GFCI service outlet, lighting, sump pump, and ventilation fan.

Transformer vaults shall have a removable cover. This cover will be no smaller than 4’x4’ and in any event it must be large enough to easily accommodate the largest piece of equipment or assembly which is installed in the vault. The cover may be aluminum plate or hot dipped galvanized steel. Provision shall be made to allow ventilation air to enter/exhaust from the vault. Vaults will have hatch(es) for electricians to readily enter the vault. All hatches shall be lockable, be easily operable by one person, and shall be a minimum of 3’ x 4’. The construction of the hatch and its hinge/counterweight mechanism shall include features to ensure continued easy operation. This includes SS, brass, and other non-rusting materials of construction. A mechanism to offset the weight of the hatch shall be included if the hatch weight exceeds 30 lbs. All fasteners, brackets, inserts, hangers, all-thread rod, etc. installed in the vault shall be SS, or better. There will be a ladder fixed to the wall under the hatch. This ladder shall be hot dipped galvanized steel, aluminum, fiberglass, or better. There will also be a retractable post assembly associated with the ladder which will allow safe entry/exit from the vault via the ladder. The hatch may incorporate a grated area to provide pathway for ventilation air. The grating should have maximum ½” openings Whenever feasible, access to the vault from an adjacent building shall be implemented.

Refer to Appendix B-4R for high efficiency harmonic cancellation transformers.

Refer to Appendix B-4S for three phase pad mounted distribution transformers.
LIGHTNING PROTECTION

All campus buildings shall have lightning protection systems.

END OF SECTION
PART B-5

INFORMATION TECHNOLOGY AND COMMUNICATION

Introduction

Unless otherwise directed, the Voice and Data Consultant will be engaged by Facilities. The Consultant shall meet with the end users, determine their voice and data needs, device locations and provide locations for construction drawings. The drawings must then be submitted to the OIT Department for review and compliance with campus standards and criteria. At this point SMU Infrastructure Design Engineers will develop the bid specifications.

Division of Responsibility

Facilities shall engage services of a SMU OIT Registered Communication Distribution Design (RCDD).

The Design Team is to provide and coordinate a layout of voice and data systems in accordance with established Campus OIT guidelines and submit to SMU OIT for approval. The Design Team shall provide drawings, and the Contractor is to provide items and services and directed in Appendix B-5A.

Voice and Data work shall be bid and awarded by mutual agreement between SMU OIT and Facilities as follows:

Campus OIT to produce bid specifications. Voice and Data to be bid as part of construction or separate as determined by SMU OIT/ Facilities.

Facilities will require Contractor to provide separate subcontractor bids for voice and data work. Sub-bids shall be solicited from SMU OIT/ Facilities pre-qualified bidders only (consult with Facilities for list of pre-qualified Voice/Data subcontractors).

Contractor’s sub-bids to be turned over to SMU OIT/Facilities for review and evaluation.

Facilities and Campus OIT to determine sub-bidder, to which Contractor or SMU will award the subcontract.

Materials, General: All new construction shall have a Cat 5 Ethernet Cable as well as a 110 volt power connection at the controller location.

General Voice and Data Design Requirements

Refer to Appendix B-5A.
Emergency Phone Requirements (Pedestals and Wall Mounted Units)

Refer to Appendix B-5B.

Mass Notification System (MNS)

Refer to Appendix B-5C.

Closed Circuit TV (CCTV)

Refer to Appendix B-5D.

Audio Video Technology Requirements

Refer to Appendix B-5E.

Digital Signage

Refer to Appendix B-5F.

END OF SECTION
PART B-6

GRAPHICS, SIGNAGE, AND WAYFINDING

Graphics

Use of the SMU Logo

The SMU logo shall not be used for any advertising or marketing purposes. The Design Team shall not incorporate the logo in the architecture or on the building unless approved in writing by the University. If the Design Team wishes to incorporate the logo into the aesthetics of the building, the proposed design, implementation, and location are subject to review and approval by Facilities. Upon approval, the logo can be found at http://smu.edu/brand/logos/.

Signage

Exterior Signage

Post and Panel Signs:

Provide one post and panel sign per building; quantity and location must be coordinated with Facilities. Any additional signage shall be coordinated and approved by Facilities through the Facilities Project Manager at the beginning of the project.

Post and panel signs shall be specified by the Design team and are Contractor-furnished, Contractor-installed (CFCI).

Building Signage:

Building signage will be determined by the University, generally no later than the conclusion of the Schematic Design phase. Building signage shall include the name of the building as determined by SMU, and be located at each main entrance of the building or as determined by SMU.

Building signage shall be specified by the Design team and are Contractor-furnished, Contractor-installed (CFCI).

Building signage material shall be cast stone or limestone unless otherwise specified by Facilities Project Manager. Letters shall be placed in respect to the joints in the stone by locating the letters first and then establishing the joints. Font
of signage shall be Times New Roman and size of at least 12 –13 inches unless otherwise specified by Facilities Project Manager.

The building’s physical street address signage shall be in a cast stone plaque at a location agreed to with the Fire Department. Lettering shall be incised and V-groove and painted a color as determined by SMU.

The building’s physical address (number only) will be coordinated by the Facilities Project Manager with the local Fire Marshall, and furnished to the Design Team.

**Interior Signage**

The font for interior signage is Avenir LT Standard 55 Roman.

**Room Identification:**

The building room numbering system shall be determined early in the project. Refer to Appendix B-6A for the room numbering system guidelines.

Room signs shall be 6”x6” window signs with the room number in Braille. Refer to Appendix B-6B for typical room sign configuration. The sign shall have message insert providing room name information that will be provided by the user.

The final design, colors, etc, are to be determined by Facilities Project Manager. The room identification sign shall meet all accessibility requirements for size, font type and Braille, mounting height, and location. (ADA, exits, stairs, egress/ evacuation signs, restrooms, etc).

Room identification signs shall be specified by the Design team and are Contractor-furnished, Contractor-installed (CFCI).

**Wayfinding and Directories:**

Wayfinding signage shall be determined at early stages of the project and coordinated with Facilities. Building directories may be located at the entry lobbies/vestibules of the building.

Directories shall be specified by the Design team and are Contractor-furnished, Contractor-installed (CFCI).

**Accessibility Signage**

Accessibility signage shall be specified by the Design team and are Contractor-furnished, Contractor-installed (CFCI).
The Font for Accessibility Signage is Avenir LT Standard 55 Roman.

Refer to Part B-1 for additional information regarding accessibility requirements.

**Temporary Construction Signage**

**Project Identification Sign**

As allowed by the requirements of the local jurisdiction. Refer to Appendix B-6C for detail drawings (to be included in the Construction Documents).

Contractor shall provide and install the project identification sign. No additional signage will be permitted on the construction site, including any subcontractor identification or advertisement signage.

**Construction Traffic Signs**

Construction traffic signs shall be provided by the Contractor. All construction traffic signs and any corresponding signage shall be coordinated with Facilities.

**Donor Recognition Signage/Plaques**

The Design Team shall coordinate with the Facilities Project Manager. The Facilities Project Manager shall coordinate with the Office of Donor Relations to determine the plaque types, sizes, quantities, and locations. Donor plaque locations are to be determined by Facilities and the Office of Donor Relations in coordination with the Architect.

Donor Recognition Signage and Plaques are Owner-furnished, Owner-installed (OFCI).

The Design Team shall coordinate with, and only take direction from the Facilities Project Manager, who will coordinate with the Office of Donor Relations, in regards to what plaques are being provided, sizes, and placement of plaques.

Note: Not all rooms and spaces may be named.

**All Donor Plaques:**

Typically 24”x 36”; larger projects may require multiple plaques. These plaques shall be located in a main entry or other high-traffic area.

**Faculty/ Staff Donor Plaque(s):**

Typically 24” x36”. Quantities to be determined by Facilities and the office of Donor Relations.
Portrait:

This is typically the namesake of the building and is determined and coordinated by Development and External Affairs (DEA), in conjunction with the Facilities Project Manager.

Biography Plaque:

This is a biographical plaque of the building’s namesake donor. This is typically located on the exterior of the building, but can be located in the interior if appropriate.

Room Donor Plaques:

The Design Team shall provide adequate space in the design to accommodate donor plaques for named rooms, and/or areas of the building. The typical sizes shall vary. In addition to plaques, the donor signage may include dimensional letters (pin-mounted letters) that are stud mounted.

Building Recognition Signage and Plaques

Building Recognition Plaques are SMU provided and SMU installed. The Design Team is to accommodate a prominent location on the façade for plaques to reside. These locations shall be on one or two sides of the building and to be coordinated with the Facilities Project Manager.

There are three Plaques that are to be mounted on the façade. Plaques are 24”x36” cast bronze. The plaques include Leadership Gift Plaque, Project Administration Plaque, and Biography Plaque (biography of donor). All of the plaques shall be located next to each other.

Other donor items shall include trees, benches, etc. All of these items shall be identified by the Office of Donor Relations and communicated and coordinated with the Facilities Project Manager.

END OF SECTION
PART C-1

FURNITURE, FIXTURES, AND EQUIPMENT

Introduction

Facilities shall handle all procurement of Furniture, Fixtures, and Equipment (FF&E). The Design Team shall coordinate the furniture needs, as expressed by the End User/User Groups with the Facilities Project Manager, Facilities Interior Design Manager, and OIT for locations of voice/data drops early in the design process. The final location shall be coordinated with the Facilities Project Manager and Facilities Interior Design Manager.

Generally, the FF&E process will consist of:

• User Group/End User to establish FF&E needs
• Design Team and Facilities shall coordinate the FF&E needs with the building systems, such as electrical and voice/data locations, thermostat, wall switches, and strobe locations
• Design Team shall create furniture layouts to ensure coordination with the building systems and adequate square footage per programming
• Design Team shall provide electronic building background files including electrical and voice/data locations to Facilities
• Design Team shall provide all finish/color schedules and material sample information to Facilities
• Facilities specifies all FF&E and associated finishes per meeting with User Group/End User
• Facilities prepares Request for Proposal (RFP) to FF&E vendors
• Facilities receives and reviews bids are received from vendors to include furniture plans
• Facilities will provide vendor plans to Design Team for final coordination with building systems
• Facilities shall award FF&E through the Purchase Order (PO) process
• Facilities to coordinate furniture delivery and associated relocations with vendors and End Users

Facilities will specify any movable furniture per the FF&E package. The Design Team shall specify all fixed and millwork items. All questionable items shall be determined by the Facilities Project Manager.
Furniture

Faculty and Staff Areas

The End User shall determine furniture needs and identify special needs. FF&E Furniture shall include desk, table, file cabinets, chairs, etc.

Classrooms

Furniture in classrooms shall be purchased by Facilities. FF&E Furniture items shall include: desks, chairs, fixed tables, etc.

Labs

The Design Team is responsible for specifying all millwork items, lab casework, lab fume hoods, and other designated lab equipment.

Support Areas and Workrooms

The Design Team shall coordinate and document all power requirements for equipment and in-wall blocking for wall mounted shelves. Facilities shall purchase desks, chairs, etc.

Lounges / Breakrooms

The Design Team shall coordinate and document all end user’s appliance needs and, specify in the Construction Documents, utility requirements (i.e. power, water, etc.) for all appliances.

Furniture in Lounge and Breakrooms shall be purchased by Facilities. FF&E Furniture items shall include: chairs, tables, etc.

Auditoriums

The Design Team shall document and specify fixed auditorium seating. This may be purchased by Facilities or the Contractor.

Miscellaneous and Other FF&E

As determined by the Design Team and Facilities Project Manager, and Facilities Interior Design Manager.

END OF SECTION
PART C-2
RELOCATION / MOVE-IN

Introduction

This section is intended as a guideline for the End Users. The information contained in this section does not involve the Design Team, but is intended for informational purposes only.

The Design Team’s responsibility is to assist with a smooth relocation/move-in process by:

- Not delaying the contractor’s operations
- Performing Punch List inspections in a timely manner
- Not delaying the construction closeout process

Facilities shall require mover/vendor to provide all necessary floor and wall protection.

The Furniture installer shall remove and discard all packaging trash and debris upon completion of furniture installation.

Owner’s Moving Guide

The following general guidelines – to be issued by Facilities to End Users - will provide a means to begin the relocation process.

Moving Contact

When moving a number of rooms within a department, it is important to identify a contact within the group to communicate with the moving crew. It will be the responsibility of this move coordinator to ensure the staff follows the instructions in the Office Moving Guide. All employees involved in the move should receive an Office Moving Guide and checklist.

Preparing for the Move

The most important part of moving an office or several offices is to plan in advance. When moving several offices allow at least 2 months of preparation, and one (1) month, scheduling notice to facility services. Being organized before the move will not only reduce the stress for those moving and other employees in the group but for the movers, as well.

In order to save time, ensure familiarity with the new location. Know exactly how large the new rooms are (it is helpful to have room dimensions). Notice any differences in shapes of the rooms.
Be sure desks, chairs, filing cabinets, etc. fit inside the new spaces. Will there be new or different furniture? Now is the time to make sure it will fit in the new location. This is a perfect time to discard outdated and unnecessary files and equipment.

**Correspond with Everyone**

Communication is vital when it comes to any office or departmental move. Make sure that everyone (employees, movers, etc.) is aware of the details. The various stakeholders need to know the moving plan before the actual move takes place. This will result in fewer questions on the day of moving which will help to reduce stress.

The movers need to know exactly where each piece of furniture should be placed. If you have many desks that look the same but belong to certain employees, make sure the movers know where each desk is to be delivered. One way of helping out the mover is by using colored labels. All of the furniture that belongs together (by offices, department or floor) can be easily identified by a colored label. Labeling is a very important tool in moving offices. Be sure to label all equipment and furniture that is being moved. The labels need to be placed in a spot that is very easily visible to the mover. The easier and more understandable you make the move to the mover, the faster the move will go. Labels may be found on the Facilities website [http://www.smu.edu/campus_planning](http://www.smu.edu/campus_planning).

**Employees**

You will be responsible for packing certain items before the actual move. If you want assistance from the movers before the move or when you unpack in the new office please ask the department move contact to submit a work order at [http://www.smu.edu/campus_planning](http://www.smu.edu/campus_planning).

**Personal Items**

The movers cannot move personal possessions, such as art, statuary, bric-a-brac, pictures, plants, etc. Please remove these items from you existing office before move day and place them in your new office after you have moved in.

**Desk Contents**

Pack all contents. This includes current working papers, letter trays, books and other desk items. Seal paper clips, pencils and all other loose materials in envelopes and then pack in boxes or crates. Protect all glass with paper or other stuffing.
SMU Artwork

Some offices may contain fine art that was provided by Meadows School of the Arts. Special arrangements must be made with the Meadows School to move this art. It cannot be moved by Facilities or Facilities service providers.

Refrigerators, Microwaves, etc.

These should be emptied and cleaned. The movers will take it from there. Once a refrigerator is moved it should not be plugged in for 24 hours. This will allow the refrigerant to settle and prevent possible damage to the cooling unit.

Unusual Items

If you have university owned items of an unusual size, shape or weight, please let the FS move-coordinator know well ahead of move time so plans can be developed or crating ordered.

Contents Being Moved

Any items inside bookcases, shelves, desks, wall units, or cupboards should all be packed securely in boxes or crates. File cabinets need to be emptied and the contents placed in crates. Make sure the crates and empty file are locked or securely fastened.

Desks Contents

Pack all contents. This includes current working papers, letter trays, books and other desk items. Seal paper clips, pencils and all other loose materials in envelopes and then pack them in boxes or crates. Protect all glass with paper or other stuffing.

Confidential Files

All confidential files should be secured in moving crates. These can be secured with plastic ties.

Supply or Storage Cabinets

Pack all contents in boxes or crates. Cabinet doors should be locked or tied. Note: the movers will need to remove the shelves (if they are not permanently secured to the cabinet) prior to the doors being locked.
Computers and Peripherals

All of these items should be turned off, disconnected from the electrical outlets and cords wrapped up before the movers arrive. If you need help from ITS, contact the Facilities move coordinator for scheduling.

Attached and/or Assembled Furniture

Any furniture or fixtures that are attached to the floor or walls must be unattached before move day. Any furniture such as cubicles must be disassembled before moving day. Facilities can make arrangements to have this done for you. Contact Plant@smu.edu to submit a service request.

"Do Not Move"

If equipment and furniture or other items are not to be moved be sure to tag them with "Do Not Move" labels. This will eliminate unnecessary expense.

Trash/Recycle

Make sure that you throw away wet trash and recycle all dry trash before the actual moving day. The more you recycle and throw away the less you have to pack! Make sure that nothing important gets thrown away. If containers or boxes are needed contact the Facilities work order desk at plant@smu.edu.

Note: Labels, plastic ties, moving crates etc. are available through Facilities. A request form is available on the Facilities website http://www.smu.edu/campus_planning.

Moving Checklist

Here's a simple checklist to ensure nothing gets left behind or overlooked:

1) Prior to Moving Day (1 to 3 months)
   □ Choose a move coordinator within the school/department that is moving
   □ Communicate with employees
   □ Choose the move day
   □ Create a master checklist of tasks
   □ Decide on the layout of the new location(s)
   □ Decide on color coded label needs
   □ Order color coded tags
2) Week Before Move (1 to 2 weeks)

- Discard all unnecessary items
- If you haven’t used it in 6 months, do you really need it?
- Empty and clean refrigerators
- Obtain moving crates/cartons
- Clear supply cabinets
- Have cubicles disassembled
- Place labels on all wall items and move to central location
- Start placing labels on furniture
- Order keys for the new location(s)
- Start packing!

3) Day Before Move

- Empty desks, etc., and secure items.
- Lock file drawers.
- Breakable items properly packed?
- Computers and other machines disconnected?
- "Do Not Move" labels placed?
- Desk pads and chair pads labeled?
- Have a set of spare keys available
- Turn in your old keys to Access Control and pick up a new key
- Move coordinator deliver old keys to Access Control
- Are you packed and ready to go?

Day of Move

- Have fun!
- If you have questions, notify the move coordinator

END OF SECTION
## Capital Projects Roles and Responsibilities
For projects with budgets of $2,000,000 or greater

<table>
<thead>
<tr>
<th>Group/Individual</th>
<th>Role/Responsibility</th>
<th>Meeting Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Project Coordinating Committee (CPC)</td>
<td>Oversee and coordinate all capital activities</td>
<td>As needed</td>
</tr>
<tr>
<td>Oversight Committee</td>
<td>Approve architect selection</td>
<td>As needed and called by the Chair of the Oversight Committee</td>
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<tr>
<td></td>
<td>Approve contractor selection</td>
<td></td>
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<tr>
<td></td>
<td>Resolve scope, budget and similar issues that arise during project</td>
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<tr>
<td></td>
<td>Determine type of level of environmental certification</td>
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<td></td>
<td>Determine whether campus standards are to be applied to project</td>
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<td></td>
<td>Determine whether project will placed on the central plant system for utilities</td>
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<tr>
<td>User Group</td>
<td>Define program of the project</td>
<td>As needed but at least monthly</td>
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<tr>
<td></td>
<td>Advise Office of Facilities Planning and Management (aka Facilities) on the program needs of the project and their facilities will coordinate the development of the formal program with the design team</td>
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<td></td>
<td>Establish sub-committees as necessary for specific portions of the project</td>
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<tr>
<td>Project Manager</td>
<td>Official communication channel between architect, contractor, owner and owner’s representatives on all issues related to the project</td>
<td>As needed</td>
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<tr>
<td></td>
<td>Resolve all technical issues related to the project with input from the user group on programmatic issues</td>
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<tr>
<td></td>
<td>Communicate with user group and program expert on issues involving program</td>
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<tr>
<td></td>
<td>Manage and oversee schedule and budget</td>
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<tr>
<td></td>
<td>Review all documents relating to the project</td>
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</tr>
<tr>
<td>Vice President for Business and Finance (VPBF)</td>
<td>Review all documents related to project</td>
<td>As needed</td>
</tr>
<tr>
<td></td>
<td>Vice Chair of the Oversight Committee</td>
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<tr>
<td></td>
<td>Advise President on various issues related to the project</td>
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<tr>
<td>Vice President for Executive Affairs (VPFEA)</td>
<td>Chairs Oversight Committee and President’s representative</td>
<td>As needed</td>
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<td></td>
<td>Advise President on progress of projects</td>
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<td></td>
<td>Inform President of issues arising during the project</td>
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</tr>
</tbody>
</table>
Benefits
1. Provides clear communication internally among SMU entities and between SMU and the Architects and Contractors.
2. Ensures most efficient use of resources and avoids time delays due to communications confusion.
3. Ensures the most effective negotiating is occurring and that the best prices are being realized.
4. Puts those with the expertise in direct contact with the Architect and Contractors, and allows the Owner and User Group to provide and receive input through the assigned Project Manager to/from the necessary external parties.

** It is understood that the CPCC is the guiding committee for all capital projects on campus.
Oversight Committee Guidelines and Process
Revised August 10, 2018

Capital construction projects will be administered by an Oversight Committee meeting the following criteria:
1. Have a total project value of $2M or more
2. Be in agreement with the University’s Campus Master Plan
3. Not be considered an infrastructure, utility, or grounds project
4. May include a donor funding source

At any time, the President of the University may request the formation of an Oversight Committee which may not fully meet the parameters as indicated above.

Oversight Committees are established once a need for a major renovation and/or expansion of an existing building or the construction of a new building is identified. The President approves each project prior to the establishment of an Oversight Committee. Oversight Committees are advisory to the President.

Each Oversight Committee has five to eight members. For all Oversight Committees, the Vice President for Executive Affairs serves as the Chair, and the Vice President for Business and Finance serves as the Vice Chair. The Associate Vice President for the Office of Facilities Planning and Management is a member of all Oversight Committees. The “owner” of the project (Vice President, Dean, Athletic Director, etc., or his/her designee) is a member of the Oversight Committee. Other members include the Provost (when applicable), the Vice President for Development and External Affairs or his/her designee, and the Chair of the User Group Committee. All members of the Oversight Committee are eligible to cast votes.

The Oversight Committee’s responsibilities are as follows:

- To review and approve the firm conduction the Feasibility/Conceptual study for a capital construction project.
- To review and approve, in consultation with the President, the Feasibility/Conceptual Study for a capital construction project. A Feasibility/Conceptual Study includes, at a minimum, the conceptual design and layout of the project, the preliminary conceptual budget estimate, and the preliminary conceptual project schedule. To approve the Architect who will provide design services once the Feasibility/Conceptual Study has been approved by the Oversight Committee. The Oversight Committee may interview prior to its approval a short list of candidate firms recommended by SMU’s Office of Facilities Planning and Management.
- To approve the General Contractor or Construction Manager who will provide construction services for the project. On occasion, the Oversight Committee may interview prior to its approval a short list of candidate firms recommended by SMU’s Office of Facilities Planning and Management.
- To approve the Schematic Design Drawings as prepared and presented by the Architect for presentation to the President for final approval of the design.
To meet periodically to ensure the budget approved for the project is in compliance with established funding levels. The Associate Vice President of SMU’s Office of Facilities Planning and Management will report when requested or when necessary the status of the project’s budget, scope of work, and project schedule should these be in conflict from what was originally approved by the Oversight Committee, and the Associate Vice President of SMU’s Office of Facilities Planning and Management will make recommendations for corrective measures for the Oversight Committee’s consideration and approval. If there are potential or significant cost overruns beyond what the project’s approved budget can manage, the Oversight Committee, in consultation with the President, will determine if additional funding is available. If additional funding is not available, the Committee will instruct the Associate Vice President of SMU’s Office of Facilities Planning and Management work with the Architect to make design changes which will cause the project to meet its originally approved budget. This process may, also, require the User Group Committee to consider a reduction in scope.

To review the interior design concept including finishes, materials, and colors as prepared and presented by the Architect prior to final approval by the President.

To maintain a liaison with the User Group Committee. When necessary, the Chair of the User Group Committee may be called upon to report to the Oversight Committee on matters related to decisions made by its committee.

To meet on issues not listed above which may require Oversight Committee input and/or approval.
SOUTHERN METHODIST UNIVERSITY
POLICIES AND PROCEDURES

GENERAL

POLICY NUMBER: 1.3

REVISED AS OF: June 1, 1994

USE OF UNIVERSITY SEAL AND LOGOS

It is the policy of the University to restrict use of the University's seal and logos, and to license their use. The University licenses its seal and logos for non-University use through the Collegiate Licensing Company in Atlanta, Georgia. The University receives royalty revenues from the sale of products carrying SMU's seal and logos. Any use of the seal and/or logos for non-University use without permission from the University and the Collegiate Licensing Company constitutes trademark infringement.
POLICY NUMBER: 8.7

REVISED AS OF: May 4, 1998

SMOKING POLICY

The University is dedicated to providing a healthy, safe, comfortable and productive work, study and social environment for faculty, staff and students. This goal can be achieved only through ongoing efforts to protect nonsmokers and help employees and students adjust to restrictions on smoking. All areas in University buildings, including residence halls and Greek houses, will be smoke-free.

The success of this policy will depend upon the thoughtfulness, consideration and cooperation of smokers and nonsmokers. All members of the SMU community share responsibility for adhering to and enforcing the policy. Any conflict should be brought to the attention of the appropriate supervisor and, if necessary, referred to the Department Head, Dean or Vice President. Personnel in the Office of Environmental Health and Safety are charged with the responsibility for interpreting this policy and reviewing questions concerning smoking issues.
CONTROLLED SUBSTANCE ABUSE IN THE WORKPLACE

A. PURPOSE

It is University policy to maintain a working environment free of the problems associated with the use of controlled substances. The unlawful use of controlled substances is inconsistent with the behavior expected of employees and subjects the University to unacceptable risks of workplace accidents or other failures that undermine the University's ability to operate effectively and efficiently. Noncompliance with the policy set forth below will result in disciplinary action.

B. DEFINITION

For purposes of this policy "controlled substances" are defined to mean those drugs listed in schedules I through V of section 202 of the Federal Controlled Substances Act, 21 U.S.C. §812, and includes, but is not limited to, marijuana, cocaine (including "crack" and other cocaine derivatives), morphine, heroin, amphetamines, and barbiturates. When used in this policy, the term "drugs" means "controlled substances." The term does not include those controlled substances used pursuant to and in accordance with a valid prescription.

C. SCOPE

1. The unlawful use, sale, possession, distribution, dispensation, manufacture, or transfer of controlled substances on University property, or other work sites where employees may be assigned, or elsewhere, during work hours is prohibited. Use, sale, possession, distribution, dispensation, manufacture, or transfer of controlled substances on non-working time to the extent such use impairs an employee's ability to perform his/her job or where such use, sale, possession, distribution, manufacture, or transfer affects the reputation of the University to the general public or threatens the University's integrity is also prohibited. Employees determined to be in violation of the policy will be subject to disciplinary action, which may include termination for a first offense.

2. Employees who are convicted of controlled substances-related violations in the workplace under state or federal law, or who plead guilty or nolo contendere to such charges, must inform the University's Director of Human Resources within five days of such conviction or plea. The Human Resources Director will make, or cause to be made, the necessary reporting of such information to the required Federal agencies. An employee's failure to report such a conviction or plea will result in disciplinary action, which may include termination from
employment for a first offense. Employees convicted of, or pleading guilty or nolo contendere to, any drug-related violations must, at their own expense, successfully complete a drug abuse assistance or similar program as a condition of continued employment or reemployment.

3. The University will provide "drug free awareness" programs which educate employees about the dangers of drug abuse as part of the University's annual training schedule.

4. In certain circumstances where the University has grants or contracts that involve classified information, national security issues, or threaten the health and safety of persons on campus, employees working in those areas or candidates for employment may be subject to additional employment requirements.
WEAPONS

A. The University prohibits the use and/or possession of dangerous weapons or facsimiles of dangerous weapons on University property. These items include but are not limited to:

1. Firearms
2. Explosives
3. Fireworks
4. Dangerous weapons
5. Incendiary Devices
6. Cross bows
7. Pellet guns
8. Blow guns
9. Stun guns
10. Swords or other sharp blades
11. Nunchuks
12. Throwing stars
13. Spear guns
14. Tear gas (This does not include self defense sprays legally sold over the counter for personal defense.)
15. Look-a-like facsimiles or toys.
B. Student-owned sporting firearms or other weapons (including all B.B. and pellet guns) must be registered and stored through arrangements with the University Department of Public Safety.

C. Any violation of this policy is considered a serious offense, and will be dealt with accordingly by:
   
   1. University Department of Public Safety
   
   2. University Judiciary
   
   3. Office of the Dean of Student Life.

D. Members duly authorized by University or other accredited law enforcement offices may carry firearms in performance of their duty.

E. If weapons or reasonable facsimiles of weapons are used, pursuit and attack games, including but not limited to Gotcha, Assassin and Dungeons & Dragons, are not permitted on campus.
SOUTHERN METHODIST UNIVERSITY
POLICIES AND PROCEDURES

PUBLIC SAFETY

POLICY NUMBER: 10.8

REVISED AS OF: June 1, 1994

NON-PRESCRIPTION DRUGS

The University prohibits the possession, use or transmission of non-prescription drugs having narcotic, addictive, hallucinogenic, and/or similar strong psychological or physiological effects.

All persons are reminded of the state and national laws pertaining to the use and possession of drugs.
POLICY ON THE USE OF SKATE BOARDS, SCOOTERS, IN-LINE SKATES, AND TRICK BIKES

It is the policy of the University that, in order to reduce the possibility of injury to persons and damage to University property, as well as to reduce risk to the University, the on-campus use of skateboards, scooters, in-line skates ("Rollerblades") and trick bikes is restricted to University faculty, staff, and students. All other individuals are prohibited from using this recreational equipment on University property. Motorized scooters are not permitted to be used on University property.

Persons permitted to use this equipment under this Policy may do so only during daylight hours, wearing at least these minimum items of safety gear: wrist braces, knee pads, elbow pads, and a helmet that has been certified to meet the ANSI or Snell testing standards. Skateboards, scooters, trick bikes or Rollerblades may be used only on uncongested sidewalks and in on-campus (non-public) streets, following the flow of vehicular traffic. Use of this equipment in any other areas of campus is not permitted. Prohibited areas include, but are not limited to: the interior of any building, steps, plazas, promenades, raised areas such as fountains or decorative architecture, in parking garages and parking lots, on or near construction sites, or in any other area of the campus that a reasonable person would consider to be unsafe.

SMU Police Officers may stop and detain any person violating this Policy and may issue a warning for the first offense. Juveniles violating this Policy for the first time and who are not SMU students, will be identified and a parent/guardian will be contacted and informed of the warning.

SMU faculty, staff, and students, who commit a second violation of this Policy, will receive an SMU Police Department citation and imposition of a fine.

Subsequent violations by any individual previously warned and/or fined for violating this Policy will result in the following:

1. Juveniles, who are not SMU students, will be detained and will be issued Criminal Trespass Warnings. Parents or guardians will be notified to take custody of detained juveniles.

2. Adults, who are not SMU students, faculty, or staff, will be issued Criminal Trespass Warnings and will be escorted off University property.
3. Currently enrolled SMU students will be referred to the University Judicial Officer for disciplinary action.

4. The appropriate supervisor will be notified when an SMU faculty/staff member violates this Policy, with possible sanctions resulting, including, but not limited to, issuance of a written notice that revokes the violator’s privilege to skate on campus.

An SMU Police Incident Report will be filed for each violation of this Policy. Persons who violate Criminal Trespass Warnings are subject to arrest by the SMU Police Department.
POLICY ON FILM AND OTHER COMMERCIAL PHOTOGRAPHY ON CAMPUS

A. The following procedure must be used in addressing requests for permission to film and/or photograph on campus for commercial purposes:

1. All requests for locations for films and other commercial photography on campus or any of its facilities should be directed to the Office of Public Affairs.

2. Each request will be fully reviewed by the Associate Vice President for Public Affairs or his/her designee and discussions held with persons responsible for the unit or building(s) involved to determine whether the granting of such requests is feasible. A designated person will be responsible for coordinating all details relating to a request to use a campus location for commercial film or photography with the Physical Plant Department and all other departments involved in a particular request.

B. Upon approval by the Associate Vice President for Public Affairs or his/her designee and the development of a schedule, a contract will be signed between the requesting party and the University. Only the Associate Vice President for Public Affairs and the Vice President for Development, Alumni Relations, and Public Affairs or their designees can approve such agreements.

In every case, the review will include:

1. appropriateness of the subject matter of the film, commercial or photograph;

2. the degree of inconvenience it would cause weighed against benefit to the University; and

3. the reputation of the requesting party.

C. In keeping with concern for community relations, the Office of Public Affairs will work to accommodate reasonable requests and to coordinate fully with the schools and other departments involved before agreeing to any location work on campus.
PET POLICY

It is the policy of the University to prohibit the presence of pets on University property, except for fish and assistance animals necessary to help persons with disabilities. This includes dormitories, residence halls, apartments, classroom and administrative buildings, the Student Center, athletic facilities, and University grounds in general. Assistance animals and fish are allowed in residence halls with the use of suitable equipment if permission is granted by the Office of Housing and Residence Life.

The University is not responsible for damage to equipment or injury to animals.
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# A/E Fee Proposal Worksheet

<table>
<thead>
<tr>
<th>Discipline</th>
<th>SD</th>
<th>DD</th>
<th>CD</th>
<th>B/E</th>
<th>CA</th>
<th>Aw. Rtns</th>
<th>Wall/Mt.</th>
<th>(Other)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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</table>

| $3,000      |  |

Last Revision: June 2019

Administrative and Procedural
BID PROPOSAL FORM

“Project Name”

Date: ________________________

TO: Southern Methodist University (hereinafter referred to as “Owner”)

FROM:

Company: _____________________________ (hereinafter referred to as “Bidder”)
Address: _________________________________
City/State/Zip: ___________________________
Phone: _________________________________
Fax: _________________________________
Email: _________________________________

The undersigned Bidder, having examined the Contract Documents, Drawings, Project Manual and Specifications, together with all Addenda thereto, and being acquainted with and fully understanding the requirements, stipulations, provisions, and conditions thereof, proposes and agrees that Bidder will enter into and perform the Contract attached thereto, for all of the items of work on which Bidder submits a bid and of which this proposal forms a part; and that Bidder will furnish all the labor, materials, and equipment called for by said Documents for the price listed below. Bidders must submit bids on all items and alternates in the following schedule.

The Bidder acknowledges receipt of the following Addenda:

__________ Dated ____________

__________ Dated ____________

__________ Dated ____________

__________ Dated ____________

In compliance with Owner’s Invitation to Bid and all Bid Documents, the Bidder hereby represents the following:

1. Bidder accepts the provisions of the Invitation to Bid and all Bid Documents.
2. Bidder has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.
3. Bidder has acknowledged receipt of Owner’s standard form of Agreement and is in agreement with terms and conditions of said Agreement.
4. Bidder will not withdraw bid for a period of ninety (90) days from the date of the Bid opening.
5. Bidder will furnish, within ten (10) days after receipt of Contract, to the Owner in writing:
   a. a designation of the Work to be performed with Bidder’s own forces;
   b. names of the manufacturers, products and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
   c. names of persons or entities (including those who are to furnish materials or equipment
fabricated to a special design) proposed for the principal portions of the Work.

6. Bidder will enter into good faith negotiations with Owner to execute a Contract with the Owner within ten (10) days of Notification of Award.

7. Bidder will deliver the required Performance and Payment Bonds to the Owner not later than five (5) days following the execution of the Agreement.

8. Bidder will deliver the required Certificate(s) of Insurance to the Owner evidencing the required types and coverage amounts within one week of Notification of Award.

9. Bidder will commence Work pursuant to an executed Agreement.

10. Bidder will accomplish the Work in accordance with the executed Agreement.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive informalities in the bidding.

NAMES(S) AND TITLE(S) OF PERSON(S) AUTHORIZED TO EXECUTE THE AGREEMENT:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

INSURANCE CARRIER: Bidder proposes to use the following firm(s) for insurance:

<table>
<thead>
<tr>
<th>Name</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>City, State, Zip</td>
<td>City, State, Zip</td>
</tr>
</tbody>
</table>

BONDING COMPANY INFORMATION: (The Owner requests the following information as a matter of record.)

<table>
<thead>
<tr>
<th>Company Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>City, State, Zip</td>
</tr>
</tbody>
</table>

Current Amount of Projects Bonded: _________________________

Largest Project Amount Bonded Last Five Years: __________________

CHECKLIST OF DOCUMENTS TO BE INCLUDED WITH BID FORM:

_______ Contractor’s Qualification Statement
In compliance with Owner’s Invitation to Bid and all Bid Documents, the Bidder hereby submits the following bid:

BASE BID AMOUNT: Bidder agrees to provide all labor and materials, equipment and supplies necessary to complete the project shown on the drawings and described in the Project Manual and Specifications entitled - “Project Name”


________________________________________________________________________


________________________________________________________________________

PERFORMANCE AND PAYMENT BOND: The cost of performance and payment bonds (which is included in the Base Bid Amount) is


________________________________________________________________________


________________________________________________________________________

ALTERNATE BID NO. ______: Add or Deduct (circle one)


________________________________________________________________________

ALTERNATE BID NO. ______: Add or Deduct (circle one)


________________________________________________________________________

ALTERNATE BID NO. ______: Add or Deduct (circle one)


________________________________________________________________________

SUBSTANTIAL COMPLETION: The date of Substantial Completion is ____________________.

UNIT PRICES FOR CHANGES IN THE WORK: If changes in the Work are approved by the Owner, the following hourly rate schedule (include hourly rate schedule for applicable labor classifications for this project) will be used for work performed by Contractor’s own forces. The hourly rate shall include regular wages, employer paid social security, federal and state unemployment taxes, workers compensation insurance, medical insurance, retirement benefits, small tools expense, overhead and profit.
OVERHEAD AND PROFIT FOR CHANGES IN THE WORK: The stated percentages for overhead and profit to be applied by Contractor, Subcontractor and any sub-subcontractors to their estimated costs, as outlined below, shall not exceed an aggregate total of Fifteen Percent (15%) for additive scope changes in the Work. The stated percentage for overhead and profit to be applied by Contractor, Subcontractor and any sub-subcontractors for deductive changes in the work shall be returned to Owner. If additive changes and deductive changes occur at the same time, the applicable percentage will apply to the overall net change.

Additive Change Orders:
1. For the Contractor: %
2. For the Subcontractor: %

Deductive Change Orders:
1. For the Contractor: %
2. For the Subcontractor: %

BID ACKNOWLEDGEMENT

The undersigned affirms that they are duly authorized to execute this Bid, that this company, corporation, firm, partnership, or individual has not prepared this Bid in collusion with any other bidder, and that the contents of this Bid as to prices, terms, or conditions of said Bid have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this Bid.

Respectfully submitted,

Firm Name

Name of Officer

Street Address

Signature of Officer

City, State, Zip Code

Title of Officer

State of Incorporation

(Seal, if by a corporation)
APPENDIX A

Bid Breakdown as per CSI Divisions

Provide a breakdown of the Bid Proposal using the following outline. Add additional line items as necessary. Please indicate with a N/A the items above that do not apply.

<table>
<thead>
<tr>
<th>Division</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GENERAL REQUIREMENTS (see Appendix B for Breakdown)</td>
<td>$</td>
</tr>
<tr>
<td>2</td>
<td>EXITING CONDITIONS</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Demolition</td>
<td>$</td>
</tr>
<tr>
<td>3</td>
<td>CONCRETE</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Cast-in-Place</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Footing &amp; Foundation</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Pre-Cast</td>
<td>$</td>
</tr>
<tr>
<td>4</td>
<td>MASONRY</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Brick</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Concrete Block</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Stone</td>
<td>$</td>
</tr>
<tr>
<td>5</td>
<td>METALS</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Structural</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Walls &amp; Framing</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Railings</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>d. Miscellaneous</td>
<td>$</td>
</tr>
<tr>
<td>6</td>
<td>WOOD AND PLASTICS</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Rough Carpentry</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Finish Carpentry</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Millwork</td>
<td>$</td>
</tr>
<tr>
<td>7</td>
<td>THERMAL AND MOISTURE PROTECTION</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Roofing</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Siding</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Insulation</td>
<td>$</td>
</tr>
<tr>
<td>8</td>
<td>DOORS AND WINDOWS</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Glazing</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Doors and Frames</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Hardware</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>d. Windows</td>
<td>$</td>
</tr>
<tr>
<td>9</td>
<td>FINISHES (TOTAL)</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>a. Drywall</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>b. Paint &amp; Wall coverings</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>c. Carpet</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>d. Other Flooring</td>
<td>$</td>
</tr>
</tbody>
</table>
Division 10  SPECIALTIES  

Division 11  EQUIPMENT  
   a. Food Service  $______________  
   b. Laboratory  $______________  

Division 12  FURNISHINGS  
   a. Window Treatments  $______________  
   b. Casework  $______________  

Division 13  SPECIAL CONSTRUCTION  

Division 14  CONVEYING SYSTEMS  
   a. Elevators  $______________  
   b. Wheelchair Lifts  $______________  

Division 21  FIRE SUPPRESSION  
   a. Fire Suppression Sys.  $______________  

Division 22  PLUMBING  
   a. Domestic  $______________  
   b. Insulation  $______________  
   c. Pumps  $______________  

Division 23  HEATING VENTILATING AND AIR CONDITIONING  
   a. HVAC Units  $______________  
   b. Hydronic Piping  $______________  
   c. Duct Work  $______________  
   c. Controls  $______________  

Division 26  ELECTRICAL  
   a. Power  $______________  
   b. Lighting  $______________  
   c. Security  $______________  

Division 27  TELECOMMUNICATIONS  
   a. Access Control  $______________  
   b. CCTV  $______________  
   c. Blue Phones  $______________
Division 28  ELECTRONIC SAFETY AND SECURITY  $_______________
  a.  Fire Alarm System  $_______________

Division 31  EARTHWORK  $_______________
  a.  Site clearing  $_______________
  b.  Grading  $_______________
  c.  Excavation  $_______________

Division 32  EXTERIORIMPROVEMENTS  $_______________
  a.  Concrete Paving  $_______________
  b.  Cast-in-Place Concrete  $_______________

BUILDING PERMIT  $_______________
PAYMENT AND PERFORMANCE BOND  $_______________
INSURANCE  $_______________
OVERHEAD/FEE  $_______________
CONTINGENCY  $_______________

TOTAL PROJECT COST  $_______________
**APPENDIX B**

**General Conditions Breakdown**

Provide a breakdown of the General Conditions using the following outline. Add additional line items as necessary. Please indicate with a N/A the items above that do not apply.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT $</th>
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</thead>
<tbody>
<tr>
<td><strong>GENERAL CONDITIONS</strong></td>
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</tr>
<tr>
<td><strong>FIELD ADMINISTRATION</strong></td>
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<tr>
<td>PROJECT MANAGER</td>
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<tr>
<td>OFFICE MANAGER</td>
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<tr>
<td>FIELD OFFICE MANAGER</td>
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<tr>
<td>SUPERINTENDENT</td>
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<tr>
<td>OTHER</td>
<td></td>
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<td></td>
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<tr>
<td><strong>TOTAL FIELD ADMINISTRATION</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>FIELD OFFICES</strong></td>
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<tr>
<td>OFFICE TRAILER</td>
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<tr>
<td>OFFICE TRAILER FREIGHT</td>
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<tr>
<td>OFFICE TRAILER-BLOCK LEVEL</td>
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<tr>
<td>OFFICE TRAILER-TEAR DOWN</td>
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<tr>
<td>OFFICE TRAILER - STAIRS/PORCHES</td>
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<tr>
<td>FENCING-TRAILER COMPOUND</td>
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PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contract Sum proposed by the undersigned is for the Work as shown on the Drawings, described in the Specifications, and otherwise defined in the Contract Documents and the Agreement between the Owner and the Contractor. However, the undersigned proposes the following substitutions for the Owner's consideration. Should the Owner accept any or all of the proposed substitutions, the proposed Contract Sum will be adjusted by the amount shown.

1.2 RELATED INFORMATION SPECIFIED ELSEWHERE

A. Section 01600 - Material and Equipment

1.3 COMPARATIVE INFORMATION

A. Provide complete comparative information as required and described in Section 01600 - Material and Equipment for review by Architect.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF PROPOSED SUBSTITUTIONS

A. Prepare a separate form with the following information for each proposed substitution.
   1. Specified product or material:
   2. Drawing number or Specification Section:
   3. Proposed Substitution:
   4. Proposed Reduction in Contract Sum:
   5. The Contractor has investigated proposed Product and determined that it meets or exceeds the quality level of the Specified Product.
      Agreed   Does Not Apply
   6. The Contractor will provide the same warranty for the Substitution as for the specified Product.
      Agreed   Does Not Apply
   7. The Contractor will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
      Agreed   Does Not Apply
   8. The Contractor waives claims for additional costs or time extension which may subsequently become apparent.
      Agreed   Does Not Apply
9. The Contractor will reimburse Owner and Architect / Engineer for all review or redesign services associated.

Agreed Does Not Apply

CONTRACTOR: _____________________________________________________

By: ________________________________________________________________

Title: _______________________________________________________________

END OF DOCUMENT 00440
BONDS AND CERTIFICATES

PART 1 - GENERAL

1.1 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

A. The "Performance Bond, Labor and Material Payment Bond", AIA Document A312, Latest Edition, will be the form used as a performance bond for this project, unless otherwise directed by the Owner.

B. Performance Bond shall be in the amount of one-hundred (100%) percent of the Contract Amount, unless otherwise directed by the Owner.

C. Copies may be purchased from the AIA in Washington, D.C. or the AIA Dallas offices.

1.2 MAINTENANCE BOND

A. A One (1) Year Maintenance Bond, in the amount of one-hundred (100%) percent of the Contract Sum, will be required for this project, unless otherwise directed by the Owner.

PART 2 - PRODUCTS      (Not Used)

PART 3 - EXECUTION      (Not Used)

END OF DOCUMENT 00600
DOCUMENT 00900 - ADDENDUM

PROJECT NAME
Address
City, State, Zip

[Architect]:
[Address]:
[City, State, Zip Code]:

ARCHITECTS PROJECT NUMBER XXXXX

Addenda will be issued as required during the bidding period and should be inserted in the Project Manual in this Section.

ADDENDUM NUMBER: ______________________  DATE: ______________________

Addendum Items 1 through [____] and attachments as indicated.

The bidding documents shall be amended, modified, deleted from or added to by the items hereinafter specified and all work affected by this addendum shall be included. Except as otherwise described, labor and material for the work hereinafter described shall conform to all requirements of the Original Specifications.

BID DOCUMENTS
ADD. 1, ITEM 01 -

CONDITIONS OF THE CONTRACT
ADD. 1, ITEM 02 -

DRAWINGS
ADD. 1, ITEM 03 -

SPECIFICATIONS
ADD. 1, ITEM 04 -

PREVIOUS ADDENDA
ADD. 1, ITEM 05 -

ATTACHMENTS
(List Attachments)

END OF ADDENDUM NUMBER: _______
Division 01
Specifications
SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project Name Identification / Definitions.
B. Project References.
C. Contractor use of site and premises.
D. Work by Owner.
E. Owner-furnished products.
F. Work sequence.
G. Contractor Duties
H. Owner occupancy.
I. Mechanical / Electrical Requirements for General Work
J. Protection of Work and Property
K. Future work.

1.2 PROJECT NAME IDENTIFICATION / DEFINITIONS

A. Project Name: The term “Project Name” as used in the Contract Documents refers to [insert project name and address].
B. Owner: The term “Owner” as used in the Contract Documents refers to Southern Methodist University.
C. Architect: The term “Architect” as used in the Contract Documents refers to [insert firm and address].

1.3 PROJECT REFERENCES

A. Summary of References: Work of the Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions, specification sections, drawings, addenda, and modifications to the contract documents issued subsequent to the initial printing of the Project Manual and including but not necessarily limited to printed material referenced by any of the aforementioned documents.
B. It is recognized that work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon including weather conditions and other forces outside the Contract Documents.

1.4 CONTRACTOR USE OF SITE AND PREMISES

A. General: Space available for all construction purposes is limited to the areas indicated on the drawings as the area of project.
   1. Limit use of site and premises to allow:
      a. Owner occupancy.
      b. Work by Others and Work by Owner.
      c. Use of surrounding streets by public.

B. Vehicular parking for Contractor employees and all construction personnel is restricted to Owner approved parking areas.

C. Contractor’s access to the site, use of the premises and conduct of the job shall be in strict compliance and accordance with rules and policies set forth by the Owner, and in accordance with applicable City, County, State of Texas, and Federal Government regulations and requirements.

D. Contractor is responsible for familiarization with Owner’s rules and policies prior to beginning any work.

E. Contractor is to abide with Owner’s instructions for scheduling work, accessing the site, and maintaining construction site security.

F. Contractor is responsible for providing all safety measures required or implied as necessary to protect all persons on the construction site and all persons and public in occupied areas adjacent to construction zones.
   1. Comply with applicable safety and security regulations of all authorities having jurisdiction. These regulations set forth minimum requirements. Contractor shall not reduce his normal safety provisions or ignore safety regulations required by other authorities having jurisdiction where other requirements are more stringent.

G. No alcoholic beverages, illegal drugs, controlled substances, or firearms of any kind are permitted on the construction site. Any person found on site with such in their possession will be escorted from the premises and not permitted to return.

H. Fighting and horseplay on the construction site are absolutely forbidden. Participants in fights will be escorted from the premises and not permitted to return.

I. Cameras are not permitted on the construction site without prior authorization from the Owner.

J. Maintain streets and sidewalks around the Project site in a clean condition. Remove all spillage and tracking arising from the performance for the Work from such areas, and establish a regular maintenance program of sweeping and hosing to minimize
accumulation of dirt and dust upon such area.

K. Access to Site: Limited to construction personnel.

L. Parking and Staging Areas: Limited to Owner approved areas.

M. Emergency Building Exits During Construction: Maintain access to existing building exits at all times and as required by the City.

N. Construction Operations and Building Access: Limited to Owner approved areas.

O. Time Restrictions for Performing Interior and Exterior Work: Coordinate work areas with Owner.

P. Utility Outages and Shutdown: Coordinate work with Owner.

1.5 WORK BY OWNER

A. Permits and Inspections: The Building Permit will be obtained and paid for by the Owner. All other permits shall be secured by the Contractor with a direct pass-through to Owner without markup. All inspections and the obtaining of a valid Certification of Occupancy will be the responsibility of the Contractor. The Contractor is to coordinate submission of and provide revised drawings for review by the City as required by the City.

B. The Owner may award additional separate contracts for work related to this project. Confirm with the Owner. Work under these contracts may include:
   1. Existing Building Demolition.
   2. Short-term site remediation.
   3. Testing and Balancing.
   7. Access Control Equipment.

C. Items noted "NIC" (Not in Contract), will be furnished and installed by Owner.

1.6 OWNER FURNISHED PRODUCTS

A. Products furnished to the site and paid for by Owner.

B. Items Furnished by Owner for Final Connection by Contractor.

C. Owner’s Responsibilities (unless otherwise directed by the Owner):
   1. Arrange for the delivery of Owner-reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or
deficient items.

5. Arrange for manufacturer’s warranties, inspections, and service.

6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.

D. Contractor’s Responsibilities (unless otherwise directed by the Owner):
   1. Review Owner-reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage, jointly with Owner.
   3. Handle, store, install, and finish products.
   4. Repair or replace items damaged after receipt.

1.7 WORK SEQUENCE

A. Construct Work to accommodate the Owner’s occupancy and scheduling requirements.

B. Before commencing Work of each phase, submit a schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

C. Secure individual permits and inspections for each separate portion of each building, as necessary to allow for completion of separate portions of the work, Certificate of Occupancy for that portion of the work, and Owner’s occupancy and use of that portion of the work prior to Substantial Completion of the entire contract’s work.
   1. Coordinate the construction schedule and the incremental sequence of completion with the Owner prior to obtaining permits.
   2. Execute Certificate of Substantial Completion for each designated portion of Work prior to Owner occupancy. Allow for access for Owner personnel and operation of the building systems.

1.8 CONTRACTOR DUTIES

A. VOC Compliance: Ensure that all assemblies, components, and systems comply with all VOC (Volatile Organic Components) requirements and regulations of the Environmental Protection Agency (EPA) Occupational Safety Health Administration (OSHA), State, County, City, and Local Air Control District.

B. Except as specifically noted, provide and pay for:
   1. Labor, materials and equipment.
   2. Tools, construction equipment, and machinery.
   4. Other facilities and services necessary for proper execution and completion of work.

C. Secure and pay for, as necessary for proper execution and completion of Work, and as applicable at time of receipt of bids:
   1. Building Permit.
   2. Licenses.
D. Give required notices.
E. Comply with all applicable local Building Codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of Work.
F. Promptly submit written notice to Architect of observed variance of Contract Documents from requirements of authorities having jurisdiction. Assume responsibility for Work performed without such notice known to be contrary to code or regulatory requirements.

1.9 OWNER OCCUPANCY

A. Accommodate Owner’s occupancy as scheduled.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
   3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.

C. Owner Occupancy of Completed Areas of Construction: The Owner reserves the right to place and install equipment in completed areas of the project and to occupy such completed areas prior to substantial completion, provided that such occupancy does not interfere with completion of the work. Such placing of equipment and partial occupancy shall not constitute acceptance of the work or any part of the work.
   1. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.
   2. Schedule the Work to accommodate this requirement.

D. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.

E. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.

F. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.
1.10 MECHANICAL/ELECTRICAL REQUIREMENTS FOR GENERAL WORK

A. General: Except as otherwise indicated, comply with applicable requirements of Division 15 and Division 16 sections for mechanical and electrical provisions within units of general construction (Division 2-14) work.

1. Service Connections: Refer to Division 15 and Division 16 sections for the characteristics of the mechanical and electrical services to be connected to units of general work. Provide units manufactured or fabricated for proper connection to and utilization of available services, as indicated. Except as otherwise indicated, final connection of mechanical services to general construction work is defined as being mechanical work, and final connection of electrical service to general construction work is defined as electrical work.

B. Electrical Requirements: Except as otherwise indicated, comply with applicable provisions of the National Electrical Code (NEC) and standards by National Electrical Manufacturer’s Association (NEMA), for electrical components of general work. Provide Underwriters Laboratories listed and labeled products where applicable.

1.11 PROTECTION OF WORK AND PROPERTY

A. The Contractor shall maintain adequate protection of the Work from damage and shall protect the Owner's and adjacent property from injury or loss arising from the Work. Contractor shall provide and maintain at all times any OSHA-required danger signs, guards, and obstructions necessary to protect the public and construction personnel from any dangers inherent with or created by the Work in progress.

1. All federal, state, and city rules and requirements pertaining to safety, and all EPA standards, OSHA standards, and NESHAP regulations pertaining to asbestos as required shall be complied with.

B. Twenty-four (24) Hour Call: The Contractor shall have personnel on call 24 hours per day, for emergencies during the course of the Project. The Owner shall be provided with a 24-hour emergency contact number of Contractor’s personnel. Contractor shall be able to respond to any emergency call and have personnel on-site within two (2) hours after contact. Numbers to be made available to the Owner shall include home, office and mobile numbers for the following:

1. Contractor’s project manager.
2. Contractor’s field superintendent.
3. Owner or company officer of Contractor.

1.12 FUTURE WORK

A. Coordinate with Owner’s requirements regarding future work.

PART 2 PRODUCTS

Not Used
PART 3  EXECUTION

Not Used

END OF SECTION 01010
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
   2. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after Contract award.
   3. Division 01 Section “Requests for Interpretation" for administrative procedures for handling RFIs.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within 10 calendar days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

5. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.


1.4 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.

2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within twenty one (21) days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than twenty one (21) days after such authorization.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.5 CHANGE ORDER PROCEDURES

1.6 CONSTRUCTION CHANGE DIRECTIVE

   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)

END OF SECTION 01019
SECTION 01020
ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Certain materials and equipment are specified in the Contract Documents by
      allowances. In some cases, these allowances include installation. Allowances have
      been established in lieu of additional requirements and to defer selection of actual
      materials and equipment to a later date when additional information is available for
      evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Unit-cost allowances - example
   2. [list additional allowances - if needed]

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when
   final selection and purchase of each product or system described by an allowance must be
   completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final
   selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.3 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form
   specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site
   for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other
   portions of the Work.

1.4 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by
   Owner under allowance and shall include taxes, freight, and delivery to Project site.

B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead
   and profit, and similar costs related to products and materials ordered by Owner under
   allowance shall be included as part of the Contract Sum and not part of the allowance.
1.5 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. [list allowances – if needed]
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for unit prices.
   1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price
      per unit of measurement for materials or services that will be added to or deducted
      from the Contract Sum by Change Order in the event the estimated quantities of
      Work required by the Contract Documents are increased or decreased.
   2. Unit prices include all necessary material, overhead and profit, and applicable taxes.
   3. Refer to individual Specification Sections for construction activities requiring the
      establishment of unit prices. Methods of measurement and payment for unit prices
      are specified in those Sections.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

A. Item No. 1 - Depth of Pier Holes:
   1. Description: Change in depth of piers from lengths indicated, in accordance with
      Section "Drilled Piers."
   2. Unit of Measurement: Linear foot of pier depth for each pier diameter.

B. Item No. 2 - Temporary Metal Casings for Pier Holes:
   1. Description: For addition of temporary metal casings, in accordance with Section
      "Drilled Piers".
   2. Unit of Measurement: Linear foot of casing for each pier diameter.

END OF SECTION 01026
SECTION 01027

APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
   1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule and List of Subcontractors.

B. The Contractor's Construction Schedule is included in Section "Construction Progress Documentation".

1.2 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
      a. Contractor's construction schedule.
      b. Application for Payment form.
      c. List of subcontractors.
      d. Schedule of allowances.
      e. Schedule of alternates.
      f. List of principal suppliers and fabricators.
   2. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of the Architect.
      c. Project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
      a. Generic name.
      b. Dollar value.
      c. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
      d. Change Orders (numbers) that have affected value.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

5. Margins of Cost: Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
   a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

6. Substantiating Data:
   a. When Architect requires substantiating information, submit data justifying item amounts in question.
   b. On allowance items, submit actual invoice from supplier of product or service.
   c. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

1.3 APPLICATIONS FOR PAYMENT:

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is as indicated in the Agreement Form. The period of construction Work covered by each Application for Payment is the period indicated in the Construction Agreement.

C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   2. Include amounts of approved Change Orders issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 3 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
   1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

F. Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
1. List of subcontractors approved for award.
2. List of principal suppliers and fabricators approved at time of submission.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. List of Contractor’s Staff Assignments.
7. Copies of authorizations and licenses from governing authorities for performance of the work.
8. Certificates of insurance and insurance policies.

G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Administrative actions and submittals that shall proceed or coincide with this application include:
1. Occupancy permits and similar approvals.
2. Warranties (guarantees) and maintenance agreements.
3. Test/adjust/balance records.
5. Meter readings, if applicable.
7. Change-over information related to Owner's occupancy, use, operation, and maintenance.
8. Final cleaning.
10. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Transmittal of required Project construction records to Owner.
4. Removal of temporary facilities and services.
5. Removal of surplus materials, rubbish, and similar elements.
6. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01027
SECTION 01030
ALTERNATES

PART 1 - GENERAL
1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for Alternates.

B. Definition: An Alternate is an amount proposed by Bidders for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected, or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.

1. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not specifically mentioned as part of the Alternate.

PART 2 - PRODUCTS
2.1 GENERAL REQUIREMENTS

A. All materials related to work described in the Alternates shall be equal to that specified for Base Bid work. Refer to each applicable section of the specifications for specific requirements relevant to this work.

B. All work is shown and detailed on the drawings.

PART 3 - EXECUTION
3.1 GENERAL REQUIREMENTS
A. All means and methods related to work described in the Alternates shall be equal to that specified for Base Bid work. Refer to each applicable section of the specifications for specific requirements relevant to this work.

B. All work is shown and detailed on the drawings.

3.2 SCHEDULE OF ALTERNATES (EXAMPLES)

A. ALTERNATE NO. 1
1. All work shall be installed per the details shown on the drawings and the requirements of each respective Specification Section. Installation shall be per manufacturer’s written instructions and approved submittals.

B. ALTERNATE NO. 2
1. All work shall be installed per the details shown on the drawings and the requirements of each respective Specification Section. Installation shall be per manufacturer’s written instructions and approved submittals.

C. ALTERNATE NO. 3
1. All work shall be installed per the details shown on the drawings and the requirements of each respective Specification Section. Installation shall be per manufacturer’s written instructions and approved submittals.

END OF SECTION 01030
1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
   2. Division 1 Section “Submittals” for requirements for the Contractor’s Construction Schedule.
   3. Division 1 Section “Applications for Payment” for administrative procedures governing applications for payment.
   4. Division 1 Section “Construction Progress Documentation” for requirements of the Contractor’s Construction Schedule.
   5. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within (10) calendar days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   5. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.


1.4 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within twenty one (21) days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than twenty one (21) days after such authorization.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.5 CHANGE ORDER PROCEDURES

1.6 CONSTRUCTION CHANGE DIRECTIVE


1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)

END OF SECTION 01035
SECTION 01039

COORDINATION AND MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Coordination.
B. Conservation.
C. Preconstruction conference.
D. Site mobilization conference.
E. Progress meetings.
F. Pre-installation conferences.

1.2 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
   1. Inform each party involved, in writing, of procedures required for coordination; include requirements for giving notice, submitting reports, and attending meetings.
   2. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   3. Where availability of space is limited, coordinate installation of different components to ensure maximum accessibility for required maintenance, service and repair.

B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate contracts where coordination of their work is required.

C. Where necessary, because of field questions which cannot be answered from information contained in the contract documents, prepare a Request for Information (RFI). See Section 01260 Request for Interpretation for administrative procedures for handling RFI's.
   1. Include:
      a. Project name
      b. Architect’s project number
      c. Date request is transmitted
      d. RFI reference number
      e. Destination (To:)
      f. Source (From:)

g. Names of subcontractor, manufacturer, supplier when pertinent
h. Required return date
i. Question
j. Contractor’s recommended/proposed answer

2. Coordinate RFI requests to allow a minimum of four (4) working days for all answers.

3. Limit each RFI to one question.

4. Transmit all RFI by e-mail to Architect and Owner with copies to Architect’s consultants where appropriate or to Owner’s other consultants.

5. Should any answer affect the Contract Cost or Schedule, immediately inform the Architect in writing. Include documentation of the anticipated cost and or schedule impact.

6. All questions whose answers are contained in the contract documents will be returned to the contractor unanswered with a notation that the answer is included in the Contract Documents.

D. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.

H. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

I. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   4. Delivery and processing of submittals.
   5. Progress meetings,
   6. Project Close-out activities.

J. Coordination Meetings: Conduct project coordination meetings at regularly scheduled times convenient for all parties involved.
   1. Project coordination meetings are in addition to specific meetings held for other purposes such as regular progress meetings and special pre-installation meetings.
2. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
3. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.3 CONSERVATION

A. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 PRECONSTRUCTION CONFERENCE

A. Owner will schedule a conference after Notice of Award.
B. Attendance Required: Owner, Architect, and Contractor.
C. Agenda:
   1. Execution of Owner Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   4. Submission of list of Subcontractors, list of Products, Schedule of Values, and Progress Schedule.
   6. Use of premises by Owner and Contractor.
   7. Owner’s requirements and occupancy of existing structures.
   8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
   9. Scheduling.
   10. Scheduling activities of Testing Service and Owner’s Contractors.
   13. Procedures for testing.
   15. Requirements for start up of equipment.
   16. Inspection and acceptance of equipment put into service during construction period.
   17. Parking availability.
   18. Office, work, and storage areas.
   19. Equipment deliveries and priorities.
   20. Working hours.
   21. Inspection required at Substantial Completion for Texas Department of Licensing and Regulations requirements for Texas Accessibility Standards compliance. Refer to Section 01700.

1.5 SITE MOBILIZATION CONFERENCE

A. Owner will schedule a conference at the Project site prior to Contractor occupancy.
B. Attendance Required: Owner's Project Manager, Architect, Special Design Consultants, General Contractor's Project Manager, General Contractor's Superintendent, major
subcontractors, manufacturers, suppliers and other concerned parties shall be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:
1. Finalized Construction Schedule.
2. Critical Work sequencing.
3. Designation of responsible personnel.
5. Procedures for processing field decisions and Change Orders.
6. Procedures for processing Applications for Payment.
7. Construction facilities and controls provided by Owner.
8. Temporary utilities provided by Owner.
9. Submittal of Shop Drawings, Product Data and Samples.
11. Contractor's use of the premises.
12. Survey and building layout.
15. Procedures for testing.
17. Requirements for start up of equipment.
18. Inspection and acceptance of equipment put into service during construction period.
19. Equipment deliveries and priorities.

1.6 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meeting with preparation of the payment request.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record notes, and distribute copies of meeting minutes within three working days to Architect, Owner, participants, and those affected by decisions made.

C. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

D. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
1. Contractor's Construction Schedule:
   a. Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   b. Detailed planned progress during succeeding work period.
2. Review the present and future needs of each entity present, including such items as:
   a. Interface requirements.
   b. Time.
   c. Requests for information log (RFI)
   d. Sequences.
   e. Deliveries.
   f. Off-site fabrication problems.
   g. Submittal log.
   h. Access.
   i. Site utilization.
   j. Temporary facilities and services.
   k. Hours of work.
   l. Hazards and risks.
   m. Housekeeping.
   n. Quality and Work standards.
   o. Architect’s Supplemental Instructions (ASI), Proposal Requests, (PR)
      Proposed Changes (PC), and Change Orders (CO).
   p. Documentation of information for payment requests.

E. Reporting: No later than three (3) days after each progress meeting date, distribute copies
   of meeting notes to each party and to other parties who should have been present. Include
   a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: Revise the construction schedule after each progress meeting
   where revisions to the schedule have been made or recognized. Issue the revised
   schedule concurrently with the report of each meeting.

1.7 PREINSTALLATION CONFERENCES

A. When required in individual specification Section, convene a pre-installation conference at
   work site prior to commencing work of the Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific
   Section.

C. Notify Owner and Architect seven (7) days in advance of meeting date.

D. Prepare agenda, preside at conference, record notes, and distribute copies within two (2)
   working days after conference to participants, with two copies to Architect.

E. Review conditions of installation, preparation and installation procedures, and coordination
   with related work.

F. Review the progress of other construction activities and preparation for the particular
   activity under consideration at each pre-installation conference, including requirements for:
   2. Options.
   3. Related Change Orders.
   4. Purchases.
   5. Deliveries.
   6. Shop Drawings, Product Data, and quality control Samples.
   7. Possible conflicts.
9. Time schedules.
10. Weather limitations.
11. Manufacturer's recommendations.
14. Temporary facilities and controls.
15. Space and access limitations.
17. Safety.
18. Inspection and testing requirements.
20. Recording requirements.
22. Warranty requirements.

G. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including Owner and Architect.

H. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)
SECTION 01045

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:
   1. Coordination of Work of the Contract.
   2. Preconstruction conferences.
   3. Scheduling and administration of progress meetings.
   4. Pre-installation conferences.

1.2 DESCRIPTION

A. Coordinate scheduling, submittals, and work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

1.3 1.4 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:
   1. Division 1 Section Field Engineering specifies procedures for field engineering services, including establishment of benchmarks and control points.
   2. Division 1 Section Submittals specifies procedures for preparing and submitting the Contractor’s Construction Schedule.
   3. Division 1 Section Materials and Equipment specifies procedures for coordinating general installation.
   4. Division 1 Section Closeout Procedures specifies procedures for coordinating contract closeout.

1.4 GENERAL COORDINATION PROVISIONS

A. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Architect of any error, inconsistency, omission, or apparent discrepancy discovered.

B. Allot time in construction scheduling for liaison with Architect, and for establishing procedures for handling queries and clarifications. Use standard "Request for Interpretation", form as approved by Architect for requesting information.

C. If Architect is able to respond to a request for interpretation by making specific reference to Drawing sheet or Specification Section, Contractor shall reimburse Owner for charges of Architect and Architect’s Consultants for performing review services for the Contractor.

D. In addition to meetings specified herein, hold coordination meetings and conferences with personnel and subcontractors to ensure coordination of Work.
E. Coordinate scheduling, submittals, and Work of various Specification sections to avoid conflicts and ensure efficient and orderly sequence of installation of interdependent construction elements.

F. Coordinate Work of various Specification sections having interdependent responsibilities for installation, connection, and operation.

G. Verify that characteristics of operating equipment are compatible with building utilities and services.

H. Except as otherwise indicated, conceal pipes, ducts, conduit, and wiring in construction. Coordinate locations of fixtures and outlets with finish elements.

I. Make provision to accommodate items scheduled for later installation.

J. Salvage materials and equipment involved in performance of, but not actually incorporated into the Work.

K. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

L. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

M. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.


O. Recheck measurements and dimensions, before starting each installation.

P. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

Q. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

R. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

S. Cleaning and Protection:
   1. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
2. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

3. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
   a. Excessive static or dynamic loading.
   b. Excessive internal or external pressures.
   c. Excessively high or low temperatures.
   d. Thermal shock.
   e. Excessively high or low humidity.
   f. Air contamination or pollution.
   g. Water or ice.
   h. Solvents.
   i. Chemicals.
   j. Light.
   k. Radiation.
   l. Puncture.
   m. Abrasion.
   n. Heavy traffic.
   o. Soiling, staining and corrosion.
   p. Bacteria.
   q. Rodent and insect infestation.
   r. Combustion.
   s. Electrical current.
   t. High speed operation,
   u. Improper lubrication,
   v. Unusual wear or other misuse.
   w. Contact between incompatible materials.
   x. Destructive testing.
   y. Misalignment.
   z. Excessive weathering.
   aa. Unprotected storage.
   bb. Improper shipping or handling.
   cc. Theft.
   dd. Vandalism.

1.5 COORDINATION DRAWINGS AND LAYOUTS

A. General:
   1. Coordination drawings are not shop drawings and are not to be submitted to Architect for approval.
   2. Coordination drawings show relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in space provided or to function as intended.
   3. Prepare composite coordination drawings to scale of 1:50 (1/4"=1= 0") or larger; detailing major elements, components, and systems of architectural, structural, mechanical, and electrical equipment and materials in relationship with each other, installations, and building components. Include dimensions.
4. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to efficient flow of Work affecting one or more trades.
5. Indicate scheduling, sequencing, movement, and positioning of large equipment into building during construction.
6. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
7. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling mounted devices.
8. Show interrelationship of components to be shown on separate Shop Drawings.
9. Indicate required installation sequences.
10. CAD drawing files may be released by the Architect to the Contractor (at no charge) after execution of a formal electronic document release form which may be obtained from the Architect.

B. Structural Systems: Include, but do not necessarily limit to following:
1. Structural frame showing interface with exterior cladding.
2. Location of openings in relation to structure.
3. Show attachments to decking, structural elements, and other systems.

C. Mechanical Systems: Include, but do not necessarily limit to following:
1. Proposed locations of piping, ductwork, equipment, and materials.
2. Proposed locations for access panels and doors.
3. Clearances for installing and maintaining insulation.
4. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance. Show access locations.
5. Equipment connections and support details.
7. Fire rated wall and floor penetrations.
8. Sizes and location of required concrete pads and bases.

D. Electrical Systems: Include, but do not necessarily limit to following:
1. Proposed locations of major raceway systems, equipment, and materials.
2. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance. Show access locations.
3. Exterior wall and foundation penetrations.
4. Fire rated wall and floor penetrations.
5. Equipment connections and support details.
6. Sizes and location of required concrete pads and bases.

E. Coordinate in field with affected trades for proper relationship to Work based on Project conditions.

F. Notify Architect of conflicts and other coordination issues requiring resolution prior to commencing construction in each affected area.
G. Submit Contractor’s certification to Architect that coordination documents have been completed and coordination issues have been identified and resolved prior to commencing construction in each affected area.

H. Make coordination documents available in field office for review by Architect and Owner during entire period of construction.

1.6 MEETINGS

A. In addition to progress meetings, hold coordination meetings and pre-installation conferences with personnel and subcontractors to assure coordination of Work. Provide a minimum two (2) working day notice to the Architect and Owner for meetings.

1.7 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals specified in Section 01300.

B. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on work of other sections.

1.8 COORDINATION OF SPACE

A. Coordinate use of Project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

B. In finished areas except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

C. In finished areas except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

D. Layout of plumbing, fire protection, mechanical, and electrical systems, equipment, fixtures, piping, ductwork, conduit, specialty items, and accessories indicated on Drawings is diagrammatic. Variations in alignment, elevation, and details required to avoid interferences and satisfy architectural and structural limitations are not necessarily shown.

E. Prior to installation of material and equipment, review and coordinate Work with Architectural and Structural Drawings to establish exact space conditions. Where available space is inadequate or where reasonable modifications are not possible, request information from Architect before proceeding.

F. Coordinate installation to prevent conflicts and cooperate in making, without extra charge, reasonable modifications in layout as needed.
G. Provide clear access to control points, valves, strainers, control devices, and specialty items of every nature related to such systems and equipment to obtain maximum head room. Provide adequate clearances as necessary for operation and maintenance.

1.9 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation for Substantial Completion of portions of Work designated for Owner partial occupancy.

B. After Owner occupancy of premises, coordinate access to site by various sections for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

C. Assemble and coordinate closeout submittals specified in Section 01770.

1.10 PRECONSTRUCTION CONFERENCE

A. Architect will schedule conference within 15 calendar days after the Notice To Proceed.

B. Attendance: Owner, Architect, Contractor and representatives of major subcontractors, and others as appropriate.

C. Architect presides over meeting and is responsible for recording and distributing minutes.

D. Agenda
   1. Submittal of executed bonds, if applicable, and insurance certificates.
   2. Execution of Owner/Contractor Agreement.
   4. Submittal of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of responsible personnel. Staff Names: Within 15 calendar days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
   6. Procedures, processing, and formats for field decisions, submittals, substitutions, applications for payments, proposal requests, change orders, and Contract closeout procedures. Formats used by Architect and Contractor must be submitted to Architect and Owner at this time and must conform to Owner requirements.
   7. Use of premises by Owner and Contractor.
   8. Owner's requirements.
   10. Survey and building layout.
   12. Schedules and sequencing.
   13. Procedures for testing.
   15. Requirements for startup and delivery of equipment.
   16. Inspection and acceptance of equipment put into service during construction period.
   17. Notification procedures for emergencies:
a. Special Note: Contractor is to notify Owner and Architect immediately upon occurrence of any incident involving personal injury, property damage, interruption of a utility source, or any other emergency. Contractor is to file a written follow-up report to Owner within 24 hours of incident.

1.11 PROGRESS MEETINGS

A. Schedule and administer weekly construction progress meetings, throughout progress of Work. Provide a minimum two (2) working day notice to the Architect and Owner for meetings.
   1. Prepare agenda and distribute notice of each meeting to participants.
   2. Make physical arrangements.
   3. Preside at meetings, record minutes, and distribute copies after meeting to participants, and to entities affected by decisions at meetings. Minutes from meetings to be distributed within 72 hours after meeting.
   4. Distribute one copy of minutes to Architect and one to Owner.
   5. Maintain in field office one copy of agenda and minutes for each conference and meeting.

B. Location of Meetings: Contractor's field office.

C. Attendance: Contractor, job superintendent, subcontractors, and suppliers as appropriate to agenda; Owner, Architect, and professional consultants as appropriate.

D. Anticipated Agenda
   1. Approval of minutes of previous meeting.
   2. Work progress since previous meeting:
      a. Current activities.
      b. Critical activities.
      c. Deviations from schedule.
   3. Field observations, problems, conflicts, and decisions.
   4. Deficiencies:
      a. Identification of items.
      b. Status of correction.
   5. Requests for Interpretations (RFIs):
      a. Status of clarification.
      b. Status of proposal requests.
   6. Changes and Modifications:
      a. Status of change orders.
      b. Pending changes.
      c. Pending claims and disputes.
      d. Clarification decisions of Architect or Owner.
   7. Problems and conflicts which impede planned progress.
   8. Construction Progress and Submittal Schedules:
      a. Off site fabrication and delivery schedules.
      b. Effect of proposed changes on construction progress schedule and coordination.
      c. Submittal schedules, status of submittals, and effect on construction progress schedule.
      d. Corrective measures to regain projected schedule.
10. Adequacy of work forces.
11. Coordination between elements of Work.
12. Maintenance of Project Record Documents.
13. Other business relating to progress of Work.

E. Meeting Minutes:
   1. Include column to indicate who is required to take action and date action is to be completed. Each of these items requiring action will be carried in subsequent minutes of meeting as "old business" until noted as "resolved."
   2. As minimum, separate into following categories:
      a. Old business.
      b. New business.
      c. Work progress.
      d. Deficiencies.
      e. RFIs.
      f. Proposed changes.
      g. Schedules.
      h. Submittals.
      i. Other business, including events to be accomplished by next meeting.
      j. Look ahead schedule.

1.12 PRE-INSTALLATION CONFERENCES

A. Schedule pre-installation conferences required in individual Specification sections. Convene at Project site prior to commencing Work of the section.

B. Attendees:
   1. Project superintendent; presides over meeting and is responsible for minutes.
   2. Subcontractor (installer, applicator, or erector).
   3. Material or equipment supplier.
   4. Manufacturer’s representative.
   5. Others directly affecting, or affected by the work.
   6. Testing agency (if necessary).
   7. Subcontractors, as appropriate.
   8. Owner, Architect, and professional consultants may attend as appropriate.
   9. Others as appropriate to agenda.

C. Notify Architect and Owner minimum four (4) working days in advance of meeting date.

D. Minimum Agenda:
   1. Access to work and conditions of proper installation.
   2. Conditions of installation, such as substrates, existing and surrounding conditions, and environmental conditions.
   3. Conditions detrimental to installation.
   4. Preparation procedures, including protection of adjacent work.
   5. Verify installer’s receipt and understanding of installation instructions.
   6. Review submittals, installation procedures, and sequence.
   7. Review coordination with other work.
   8. Evaluate delivery schedule and Construction Progress Schedule.
10. Required protection procedures.
11. Change order procedures.
12. Safety.
13. Inspection and testing.
15. Recording requirements.

E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

1.13 CLOSEOUT CONFERENCE

A. Schedule Project Closeout conference prior to requesting Substantial Completion.

B. Attendees:
   1. Contractor; presides over meeting and is responsible for minutes.
   2. Major subcontractors.
   3. Owner, Architect, and professional consultants may attend as appropriate.
   4. Others as appropriate to agenda.

C. Minimum Agenda:
   1. Start-up of facilities and systems.
   2. Testing, adjusting, and balancing.
   3. System demonstration and observation.
   4. Operation and maintenance instructions for the owner’s personnel.
   5. Contractor’s inspection of work.
   6. Contractor’s preparation of an initial "punch list."
   7. Procedure to request Architect and Owner inspection to determine date of substantial completion.
   8. Completion time for correcting deficiencies.
   9. Inspections by authorities having jurisdiction.
   10. Certificate of occupancy and transfer of insurance responsibilities.
   11. Partial release of retainage.
   12. Preparation for final inspection.
   13. Closeout submittals:
      a. Project Record Documents.
      b. Operating and maintenance documents.
      c. Operating and maintenance materials.
      d. Warranties and bonds.
      e. Affidavits.
   14. Final application for payment.
   15. Final cleaning.
   16. Contractor’s demobilization of site.
   17. Maintenance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)
SECTION 01050
FIELD ENGINEERING / SURVEYING

PART 1 - GENERAL

1.1 SUMMARY

A. Quality control.
B. Submittals.
C. Project Record Documents.

1.2 RELATED SECTIONS

B. Section 01019 – Contract Modification Procedures: Measurement for Work requiring unit price payment.
C. Section 01700 – Contract Closeout: Project Record Documents.

1.3 QUALITY CONTROL

A. Employ a Land Surveyor registered in the State of Texas and acceptable to Owner to perform land surveying services required.
B. Employ a Professional Engineer of the discipline required for specific service on Project, licensed in the State of Texas to perform required engineering services.
C. Instrument Operators: Provide certified instrument operators for laying out work and establishing working points.
D. Submit evidence of Surveyor's and Professional Engineer's E&O insurance coverage in the form of an Insurance Certificate.

1.4 SUBMITTALS

A. Submit name, address, and telephone number of Surveyor and Professional Engineer before starting survey work.
B. On request, submit documentation verifying accuracy of survey work.
C. Submit a copy of registered site drawing and certificate signed by the Land Surveyor or Professional Engineer certifying that the elevations and locations of the Work are in conformance with Contract Documents.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.
B. On completion of foundation and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

C. Submit Record Documents under provisions of Section 01700.

1.6 EXAMINATION

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

1.7 SURVEY REFERENCE POINTS

A. Owner will locate and General Contractor is to protect survey control and reference points.

B. Control datum for survey is that established by Owner provided survey.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Owner the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Owner.

1.8 SURVEY REQUIREMENTS

A. Provide field engineering services. Utilize recognized engineering survey practices.

B. Establish a permanent bench marks noted in Part 3 - Execution.

C. Periodically verify layouts by same means.

D. Promptly notify Owner and Architect/Engineer of any errors or discrepancies encountered.

1.9 SURVEYS FOR MEASUREMENT AND PAYMENT

A. Perform surveys to determine quantities of unit cost work, including control surveys to establish measurement reference lines. Notify Architect / Engineer prior to starting work.

B. Contractor's Engineer shall sign surveyor's field notes or keep duplicate field notes and shall calculate and certify quantities for payment purposes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION
3.1 PREPARATION AND PROCEDURES

A. Existing basic horizontal and vertical control points for the project are designated on the drawings.

B. Verify layout information shown on the drawings in relation to existing benchmarks before proceeding to lay out the work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
2. Require surveyor to promptly replace lost or destroyed project control points. Base replacements on the original survey control points.

3.2 BENCHMARKS AND REFERENCES

A. Establish and maintain a minimum of two each permanent horizontal and vertical benchmarks on the site, referenced to data established by survey control points.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents. Verify all dimensions and compare to existing conditions prior to laying out the work.
2. Verify setbacks and distances to property lines from external corner locations for building.
3. Establish and clearly define reference lines and levels; locate and lay out by instrumentation and similar appropriate means the following:
   a. Batter boards for structure.
   b. Building foundations, column locations, and floor levels.
   c. Controlling lines and levels required for mechanical and electrical trades.
4. Verify layouts periodically during the course of the work using the same methods.
5. Maintain a complete, accurate log of all control and survey work as it progresses.
6. The Contractor is responsible for the layout of his work and for providing control lines and levels at all levels of the building.

B. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.3 PERFORMANCE

A. Working from established benchmarks and lines and levels, establish markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale drawings to determine dimensions.
1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level, and plumb.
B. Surveyor’s Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.
   1. Record deviations from required lines and levels, and advise the Architect / Engineer when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
   2. On completion of foundation, major site improvements, and other work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

C. Site Improvements: Locate and lay outside improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

END OF SECTION 01050
SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Quality assurance.

B. Schedule of references.

1.2 RELATED SECTIONS


1.3 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Conform to reference standard by date of issue current on date for receiving bids or date of Owner/Contractor Agreement when there are no Bids.

C. When required by Contract Documents obtain copies of standards maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion. Copies of applicable standards are not bound with the Contract Documents.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. “Project Site”: Space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

L. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

1.5 SCHEDULE OF REFERENCES

A. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.
   2. Referenced standards may be obtained through appropriate web sites:
      a. ASTM: www.astm.org
      b. ANSI: www.ansi.org/catalog/search.html
      c. NFPA: www.nfpa.org/products/listing.html
B. Abbreviations and Acronyms for Standards and Regulations: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication.

C. Industry Organizations: Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.,” which are available in most libraries.

1. AA  Aluminum Association  
   818 Connecticut Avenue, N.W.  
   Washington, DC  20006

2. AWI Architectural Woodwork Institute  
   2310 South Walter Reed Drive  
   Arlington, VA  22206

3. AWI Architectural Woodwork Institute  
   2310 South Walter Reed Drive  
   Arlington, VA  22206

4. AWPA American Wood Preservers' Association  
   7735 Old Georgetown Road  
   Bethesda, MD  20014

5. AWS American Welding Society  
   550 LeJeune Road, N.W.  
   Miami, FL  33135

6. AWWA American Water Works Association  
   6666 West Quincy Avenue  
   Denver, CO  80235

7. BIA Brick Institute of America  
   11490 Commerce Park Drive  
   Reston, VA  22091

8. CDA Copper Development Association  
   57th Floor, Chrysler Building  
   405 Lexington Avenue  
   New York, NY  10174

9. CLFMI Chain Link Fence Manufacturers Institute  
   1101 Connecticut Avenue, N.W.  
   Washington, DC  20036

10. CRSI Concrete Reinforcing Steel Institute  
    933 Plum Grove Road  
    Schaumburg, IL  60195

11. DHI Door and Hardware Institute  
    7711 Old Springhouse Road  
    McLean, VA  22102

12. EJCDC Engineers' Joint Contract Documents Committee  
    American Consulting Engineers Council  
    1015 15th Street, N.W.  
    Washington, DC  20005
13. EJMA Expansion Joint Manufacturers Association  
   25 North Broadway  
   Tarrytown, NY 10591  
14. FGMA Flat Glass Marketing Association  
   3310 Harrison  
   White Lakes Professional Building  
   Topeka, KS 66611  
15. FM Factory Mutual System  
   1151 Boston Providence Turnpike  
   P.O. Box 688  
   Norwood, MA 02062  
16. FS Federal Specification  
   General Services Administration  
   Specifications and Consumer Information  
   Distribution Section (WFSIS)  
   Washington Navy Yard, Bldg. 197  
   Washington, DC 20407  
17. GA Gypsum Association  
   810 First Street, Suite 510  
   Washington, DC 20002  
18. ICBO International Conference of Building Officials  
   5360 S. Workman Mill Road  
   Whittier, CA 90601  
19. IEEE Institute of Electrical and Electronics Engineers  
   345 East 47th Street  
   New York, NY 10017  
20. IMIAC International Masonry Industry All Weather Council  
   International Masonry Institute  
   815 15th Street, N.W.  
   Washington, DC 20005  
21. MBMA Metal Building Manufacturer's Association  
   1230 Keith Building  
   Cleveland, OH 44115  
22. MFMA Maple Flooring Manufacturers Association  
   60 Rivere Drive  
   Northbrook, IL 60062  
23. MIL Military Specification  
   Naval Publications and Forms Center  
   5801 Tabor Avenue  
   Philadelphia, PA 19120  
24. ML/SFA Metal Lath/Steel Framing Association  
   221 North LaSalle Street  
   Chicago, IL 60601  
25. NAAMM National Association of Architectural Metal Manufacturers  
   221 North LaSalle Street  
   Chicago, IL 60601
26. NCMA National Concrete Masonry Association  
P.O. Box 781  
Herndon, VA  22070
27. NEBB National Environmental Balancing Bureau  
8224 Old Courthouse Road  
Vienna, VA  22180
28. NEMA National Electrical Manufacturers' Association  
2101 'L' Street, N.W.  
Washington, DC  20037
29. NFPA National Fire Protection Association  
Battery March Park  
Quincy, MA  02269
30. NFPA National Forest Products Association  
1619 Massachusetts Avenue, N.W.  
Washington, DC  20036
31. NSWMA National Solid Wastes Management Association  
1730 Rhode Island Ave., N.W.  
Washington, DC  20036
32. NTMA National Terrazzo and Mosaic Association  
3166 Des Plaines Avenue  
Des Plaines, IL  60018
33. NWMANational Woodwork Manufacturers Association  
205 W. Touhy Avenue  
Park Ridge, IL  60068
34. PCA Portland Cement Association  
5420 Old Orchard Road  
Skokie, IL  60077
35. PCI Prestressed Concrete Institute  
201 North Wells Street  
Chicago, IL  60606
36. PS Product Standard  
U. S. Department of Commerce  
Washington, DC  20203
37. RIS Redwood Inspection Service  
One Lombard Street  
San Francisco, CA  94111
38. RCSHSB Red Cedar Shingle and Handsplit Shake Bureau  
515 116th Avenue  
Bellevue, WA  98004
39. SDI Steel Deck Institute  
P.O. Box 9506  
Canton, OH  44711
40. SDI Steel Door Institute  
712 Lakewood Center North  
14600 Detroit Avenue  
Cleveland, OH  44107
41. SIGMA Sealed Insulating Glass Manufacturers Association  
   111 East Wacker Drive  
   Chicago, IL  60601
42. SJI Steel Joist Institute  
   1205 48th Avenue North  
   Suite A  
   Myrtle Beach, SC  29577
43. SMACNA Sheet Metal and Air Conditioning Contractors' National Association  
   8224 Old Court House Road  
   Vienna, VA  22180
44. SSPC Steel Structures Painting Council  
   4400 Fifth Avenue  
   Pittsburgh, PA  15213
45. TCA Tile Council of America, Inc.  
   Box 326  
   Princeton, NJ  08540
46. UL Underwriters' Laboratories, Inc.  
   333 Pfingston Road  
   Northbrook, IL  60062
47. WCLIB West Coast Lumber Inspection Bureau  
   6980 S.W. Varns Road  
   Box 23145  
   Portland, OR  97223
48. WWPA Western Wood Products Association  
   1500 Yeon Building  
   Portland, OR  97204

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)
SECTION 01150
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS
A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 CUTTING AND PATCHING
A. Employ skilled and experienced installer to perform cutting and patching.
B. Submit written request in advance of cutting or altering elements which affects:
   1. Structural integrity of element.
   2. Integrity of weather exposed or moisture resistant elements.
   3. Efficiency, maintenance, or safety of element.
   5. Work of Owner or separate contractor.
C. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
   1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
   2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
   3. List products to be used and firms or entities that will perform Work.
   4. Indicate dates when cutting and patching is to be performed.
   5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
   6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
   7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.
D. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

E. Execute work by methods which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

F. Cut rigid materials using masonry saw or core drill.

G. Restore Work with new products in accordance with requirements of Contract Documents.

H. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

K. Identify any hazardous substance or condition exposed during the Work to the Architect for decision or remedy.

L. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
   1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
      a. Foundation construction.
      b. Bearing and retaining walls.
      c. Structural concrete.
      d. Structural steel.
      e. Lintels.
      f. Timber and primary wood framing.
      g. Structural decking.
      h. Stair systems.
      i. Miscellaneous structural metals.
      j. Exterior curtain wall construction.
      k. Equipment supports.
      l. Piping, ductwork, vessels and equipment.
      m. Structural systems of special construction in Division 13.

M. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
   1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
      a. Shoring, bracing and sheeting.
      b. Primary operational systems and equipment.
c. Air or smoke barriers.

d. Water, moisture, or vapor barriers.

e. Membranes and flashings.

f. Fire protection systems.

g. Noise and vibration control elements and systems.

h. Control systems.

i. Communication systems.

j. Conveying systems.

k. Electric wiring systems.

l. Special construction specified by Division 13 Sections.

N. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

   a. Processed concrete finishes.

   b. Stonework and stone masonry.

   c. Ornamental metal.

   d. Matched-veneer woodwork.

   e. Preformed metal panels.

   f. Window wall system.

   g. Acoustical ceilings.

   h. Fluid-applied flooring.

   i. Carpeting.

   j. Aggregate wall coating.

   k. Wall covering.

   l. HVAC enclosures, cabinets, or covers.

O. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS FOR CUTTING AND PATCHING

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS
A. Inspection of Conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Comply with TAS mounting heights where applicable. Refer questionable mounting height decisions to the Architect for final decision.

J. Roofing: Where penetrations are made through the roof system to accommodate mechanical, electrical, or plumbing systems, or any other reason associated with the Work, repair in accordance with the original manufacturer’s requirements. Install curbs, cants, flashing and other roof system components in accordance with Specifications within this Project Manual and recommendations by the manufacturer of the roof system presently in place. Return assembly to weather-tight condition. Also refer to Division 07 section on roof modifications or repairs.

K. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
C. Limiting Exposures: Each Prime Contractor shall supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
19. Electrical current.
20. High speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

3.3 INSPECTION FOR CUTTING AND PATCHING

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

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

3.4 PREPARATION FOR CUTTING AND PATCHING

A. Temporary Support: Provide temporary support of Work to be cut.
B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

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

D. Take all precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.5 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original condition.

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

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.

4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.

5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

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

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
a. Where patching occurs in a smooth painted surface, extend final paint cover over entire unbroken containing the patch, after the patched area has received primer and second coat.

3.6 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01150
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for submitting and processing Requests for Interpretation (RFIs) after execution of the Agreement:

1.2 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified in the Appendix.

1. RFI shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials.

C. Hard-Copy RFIs: CSI Form 13.2A included in Appendix.

1. Identify each page of attachments with the RFI number and sequential page number.
D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
   1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and return it per the number of calendar days outlined in the agreement for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Requests for adjustments in the Contract Time or the Contract Sum.
      e. Requests for interpretation of Architect's actions on submittals.
      f. Incomplete RFIs or RFIs with numerous errors.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section 01019 "Contract Modification Procedures."
   4. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within the number of days outlined in the agreement of calendar days of receipt of the RFI response.
   5. RFIs involving request for remedial action to correct nonconforming work, which are returned in more than the time allowed by the agreement, are not eligible for Contractor’s request for an increase in Contract Sum or an extension of Contract Time.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect in the time allowed by the agreement if Contractor disagrees with response.

G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit updated log at each Construction Progress Meeting. Provide software log with not less than the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were dropped and not submitted.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)
END OF SECTION 01260
## REQUEST FOR INTERPRETATION

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Request:

Signed by:          Date:  

Response:

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Signed by:          Date:  

Copies:  ☐ Owner  ☐ Consultants  ☐ _______  ☐ _______  ☐ _______  ☐ _______  ☐ File
PART 1 - GENERAL

1.1 SUMMARY

A. Submittal procedures.
B. Proposed products list.
C. Shop drawings.
D. Product data.
E. Samples.
F. Informational Submittals
   G. Manufacturers' instructions.
   H. Manufacturers' certificates.
   I. Construction photographs.

1.2 RELATED SECTIONS

A. Section 01019 – Contract Modification Procedures: Application for Payment
B. Section 01019 Contract Modification Procedures: Schedule of Values.
C. Section 01310 – Schedules
D. Section 01400 – Quality Control: Field Samples
E. Section 01400 – Quality Control: Mock-Up.
F. Section 01400 Quality Control: Manufacturers' field services and reports.
G. Section 01700 Contract Closeout: Contract closeout submittals including warranty and manufacturer's certificates.

1.3 SUBMITTAL PROCEDURES

A. Prepare and submit Submittals required by individual Specification Sections.
   1. Number of Copies:
      a. Submit four copies of each submittal, unless otherwise indicated. Architect will retain one copy and return three copies. Mark up and retain one returned copy as a Project Record Document. Copies shall be distributed as follows:
         1) One copy for Contractor’s use.
2) One copy for subcontractor’s use.
3) One copy shall be provided to the Owner. Furnish Owner with final copy designated as “Approved” or “Approved as Noted” only.
4) Contractor shall be responsible for providing additional copies as required for additional personnel, field use, etc.
b. Submit one extra set of submittals to be retained by Architect’s consultant, where the consultant was delegated design responsibility for that item of work to which submittal pertains.
c. Submit one extra set of applicable Division 15 and Division 16 related submittals for Commissioning of HVAC system.
2. Transmit each submittal with form acceptable to Architect.
a. Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
   1) Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
   2) Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
b. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
c. Use only final submittals with mark indicating “Approved” or “Approved as Noted” action taken by Architect in connection with construction.

B. Coordination: Coordinate preparation and processing of submittals with performance of the Work. Transmit each submittal to the Architect sufficiently in advance of scheduled performance of related construction activities to avoid delay.
1. Coordinate each submittal with other submittals and related activities that require sequential activity including:
   a. Testing.
   b. Purchasing.
   c. Fabrication.
   d. Delivery.
2. Coordinate transmittal of different types of submittals for the same element of the Work and different elements of related parts of the Work so that processing will not be delayed by the Architect's need to review submittals concurrently for coordination.
   a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are forthcoming.
3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
   a. Allow fourteen (14) calendar days for the Architect’s initial review of each submittal. Where processing must be delayed to permit coordination with subsequent submittals, allow additional time. The Architect will advise the Contractor promptly when a submittal being processed must be delayed for coordination.
   b. Where necessary to provide an intermediate submittal between the initial and final submittals, process the intermediate submittal in the same manner as the initial submittal.
c. Allow ten (10) calendar days for reprocessing each resubmittal.
d. No extension of time will be authorized because of Contractor's failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

C. Submittal Preparation: Place a permanent label or title block on each submittal for identification.
   1. Indicate the name of the firm or entity that prepared each submittal on the label or title block.
   2. Provide a space approximately 4" x 5" on the label or beside the title block to record the Contractor's review and approval markings and the action taken by the Architect.
   3. Include the following information on the label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Construction Manager.
      e. Name and address of Contractor.
      f. Name and address of subcontractor.
      g. Name and address of supplier.
      h. Name of manufacturer.
      i. Number and title of appropriate Specification Section.
      j. Drawing number and detail references, as appropriate.
      k. Similar definitive information as necessary.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

E. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

F. Provide space for Contractor and Architect/Engineer review stamps.

G. Revise and resubmit submittals as required. Identify all changes made since previous submittal.

H. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

I. Do not commence work which requires review of any submittals until receipt of returned submittals with an acceptable action.

J. Submittals without an acceptable action marking are not to be used for the project.

K. Do not submit substitute items that have not been approved by means of the procedure specified in Section 01630.

L. Do not include requests for substitution (either direct or indirect) on submittals; comply with procedures for substitutions specified elsewhere.
M. Organize Submittals as complete packages to the greatest extent possible, including all items listed in Part 1 of each Section under Submittals and Quality Assurance.

N. Contractor to review all products for which submittals are required and all other products proposed to be incorporated into the work whether or not included in a submittal, to determine if asbestos or any other hazardous material as listed in the Environmental Protection Agency (EPA) “List of Hazardous Materials” or any other governmental agency having jurisdiction over this project is a component of the proposed product. It is the intent of these Contract Documents that no product containing a hazardous material in amounts in excess of those permitted by the EPA be incorporated into the work of this contract. Should the Contractor, through his review, determine that a specified or proposed product contain hazardous material, that product should not be submitted for review or incorporated into the work. If a substitute product is required to meet the intent of the Contract Documents a substitution request shall be submitted or required by Section 01630 and Section 01631.

O. Timing of Submittals:
1. Transmit each submittal at or before the time indicated on the approved schedule of submittals.
2. Deliver each submittal requiring approval in time to allow for adequate review and processing time, including resubmittal if necessary. Where processing must be delayed to permit coordination with subsequent submittals, allow additional time. The Architect will advise the contractor promptly when a submittal being processed must be delayed for coordination. Failure of the Contractor in this respect will not be considered as grounds for an extension of the contract time.
3. Deliver each informational submittal prior to start of the work involved, unless the submittal is of a type which cannot be prepared until after completion of the work; submit promptly.
4. If a submittal must be processed within a certain time in order to maintain the progress of the work, state so clearly on the submittal.
5. Allow fourteen (14) calendar days for the first processing of each submittal. Allow more time when submittals must be coordinated with other submittals.
6. Allow ten (10) calendar days for processing of resubmittals.

P. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect, and to other destinations, as indicated by use of a transmittal form. Submittals received from sources other than the Contractors will be returned to the sender without action.
1. Record relevant information and requests for data on the transmittal form. On the form, or an attached separate sheet, record deviations from requirements of the Contract Documents, including minor variations and limitations.
2. Include the Contractor's signed certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Prepare a draft of a transmittal form and submit it to the Architect for acceptance. Provide places on the form for the following information:
   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:)
   e. Names of subcontractor, manufacturer and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Submittal and transmittal distribution record.
i. Remarks.
j. Signature of transmitter.

1.4 ADMINISTRATIVE SUBMITTALS

A. Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
1. Permits.
2. Performance and payment bonds.
3. Insurance certificates.

1.5 STAFF NAMES

A. Within ten (10) days of Notice to Proceed, submit a list of the Contractor’s principal staff assignments, including the Project Manager, Superintendent and other personnel in attendance at the site. Identify individuals, their duties, and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the project meeting room, the temporary field office, and at each temporary telephone.
2. Staff members may be changed or reassigned only upon termination by Contractor or by written consent of Owner.

1.6 PROPOSED SUBCONTRACTOR AND MATERIAL SUPPLIERS LIST

A. Within ten (10) days after date of Notice to Proceed, submit initial list of major subcontractors and material suppliers proposed for use, with name and address of company, contact, telephone number, fax number, and e-mail address for each subcontractor/material supplier. Continue to submit updated major materials and subcontractors list weekly until list is complete.

1.7 PROPOSED PRODUCTS LIST

A. Within ten (10) days after date of Notice to Proceed, submit initial list of major products proposed for use, with name of manufacturer, trade name, and model number of each product. Continue to submit updated major materials list weekly until list is complete.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.8 SHOP DRAWINGS

A. Shop Drawings include, but are not limited to, the following:
1. Fabrication Drawings.
2. Installation Drawings.
5. Templates and patterns.
7. Design mix formulas.
   a. Standard information prepared without specific reference to the Project is not considered to be Shop Drawings.

B. Submit in the form of one (1) reproducible transparency and three (3) opaque reproductions routed directly to the Architect. The marked up reproducible transparency and two marked-up opaque copies will be returned to the contractor of which one is to be used for the record documents. Additional opaque reproductions will be returned to the contractor not reviewed.
   1. Content:
      a. Dimensions, at accurate scale.
      b. Notation of dimensions established by field measurement at accurate scale.
      c. Names of specific products and materials included.
      d. Details, identified by Contract Document sheet and detail numbers.
      e. Show compliance with the specific standards referenced.
      f. Coordination requirements; show relationship to adjacent or critical work.
   2. Preparation:
      a. Submit newly prepared information, drawn to an accurate scale.
      b. Reproductions of Contract Documents or copies of standard printed information submitted as shop drawings will be returned to the Contractor marked Rejected.
      c. Identify as indicated for all submittals.
      d. Space for Architect’s action marking shall be adjacent to the title block.
   3. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.

4. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8 1/2” x 11” but no larger than 30” x 40”.

C. After review, reproduce and distribute in accordance with Article on Submittal Procedures above and for Record Documents described in Section 01700 Contract Closeout.

D. Do not permit Shop Drawing copies without an appropriate final stamp or other marking indicating the action taken by the Architect to be used in connection with construction.

E. One final version of all Shop Drawings to be retained by Contractor and provided to Owner as a condition of request for payment of final retainage for that trade or material supplier.

1.9 COORDINATION DRAWINGS

A. Provide coordination drawings where limited available space may cause conflicts in the locations of installed products, where required to coordinate installation of products and/or scheduled.

B. Submit in the form of one (1) reproducible transparency and three (3) opaque reproductions routed directly to the Architect. The marked up reproducible transparency and two marked-up opaque copies will be returned to the contractor of which one is to be used for the record documents. Additional opaque reproductions will be returned to the contractor not reviewed.
   1. Where space is limited, prepare and submit coordinated composite layouts of the mechanical systems and equipment for all areas, drawn at a scale not less than 1/4" per foot showing on both plan cross section and elevation, including, but not limited
to, all equipment, ducts, pipe sleeves, piping including plumbing and sprinkler
system, lighting, special supports and other items contained within the space. Show
mechanical and electrical services as well as architectural and structural features
drawn to scale. Provide composite drawings for all congested areas such as
corridors, specialty spaces, mechanical rooms, shafts, or tunnels.
2. Show the interrelationship of components shown on separate shop drawings.
3. Indicate building structure, showing location and size of openings and sleeves
required or constructed in slabs, walls, beams, and other structural elements.
Include required openings not indicated in the Contract Documents. Show slab edge
locations.
4. Indicate required installation sequences.
5. Refer to Division 15 section "Basic Mechanical Requirements," and Division 16
section "Basic Electrical Requirements" for specific coordination drawing
requirements for mechanical and electrical installations.
6. Distribute copies of composite drawings to all trades to assure a complete,
coordinated installation of work within the space available.

1.10 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system.
Mark each copy to show which choices and options are applicable to the Project.
1. Where Product Data have been printed to include information on several similar
products, some of which are not required for use on the Project, or are not included
in this submittal, mark copies to clearly indicate which information is applicable.
2. Where Product Data must be specially prepared for required products, materials or
systems, because standard printed data are not suitable for use, submit as "Shop
Drawings" not "Product Data."
3. Include the following information in Product Data:
a. Manufacturer's printed recommendations.
b. Compliance with recognized trade association standards.
c. Compliance with recognized testing agency standards.
d. Application of testing agency labels and seals.
e. Notation of dimensions verified by field measurement.
f. Notation of coordination requirements.
4. Do not submit Product Data until compliance with requirements of the Contract
Documents has been confirmed.

B. Product Data include, but are not limited to, the following:
1. Manufacturer's product Specifications.
2. Manufacturer's installation instructions.
4. Catalog cuts.
5. Roughing-in diagrams and templates.
7. Printed performance curves.
8. Operational range diagrams.
10. Standard product operating and maintenance manuals.
C. Submit the number of copies which the Contractor requires, plus one copy which will be retained by the Architect. Submit additional copies where copies are required for maintenance manuals. The Architect will each retain one (1) copy, and will return the other marked with the action taken and corrections or modifications required.

D. Content: (Mark each copy to identify applicable products only)
1. Identify the particular product being submitted; submit only pertinent pages.
2. Show compliance with properties specified.
3. Identify which options and accessories are applicable.
4. Include manufacturer’s recommendations for application and use.
5. Show compliance with the specific standards referenced.
6. Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
7. Supplement manufacturer’s standard data to provide information unique to this Project.
8. Notation of dimensions verified by field measurement.
9. Notation of coordination requirements.

E. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01700 Contract Closeout. Furnish copies of final Product Data submittal to manufacturers, subcontractors, suppliers, fabricators, installers, governing authorities and others as required for performance of the construction activities. Show distribution on transmittal forms.
1. Do not proceed with installation of materials, products, and systems until a copy of Product Data applicable to the installation is in the installer's possession.
2. Do not permit use of unmarked copies of Product Data in connection with construction.

1.11 SAMPLES

A. Samples include, but are not limited to, the following:
1. Partial Sections of manufactured or fabricated components.
2. Small cuts or containers of materials.
3. Complete units of repetitively-used materials.
4. Swatches showing color, texture and pattern.
5. Color range sets.
6. Components used for independent inspection and testing.

B. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

C. Submit Samples physically identical with the material or product proposed for use; submit full-size, fully fabricated Samples, cured and finished in the manner specified.

D. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect’s Sample where so indicated.

E. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns or in custom colors, textures, and patterns for Architect selection as indicated in the individual sections.
F. Include the following information:
1. Generic Description of the Sample.
2. Size limitations.
3. Sample source.
4. Product name or name of manufacturer.
5. Compliance with recognized standards.
6. Compliance with governing regulations.
7. Availability.
8. Delivery time.

G. Submit the number of samples which the Contractor requires plus one which will be retained by Architect.

H. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

I. Submit Samples for review of kind, color, pattern and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
   1. Where variations in color, pattern, texture or other characteristics are inherent in the material or product represented by a Sample, submit sets of multiple units of the Sample (not less than 3 units), which show approximate limits of the variations.
   2. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
   3. Refer to other Specification Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be in an undamaged condition at time of use. On the transmittal form, indicate such special requests regarding disposition of Sample submittals.

J. Preliminary Submittals: Where Samples are specified for selection of color, pattern, texture, or similar characteristics from a manufacturer's range of standard choices, submit a single, full set of available choices for the material or product.
   1. Preliminary submittals will be reviewed and returned with the Architect's marking indicating selection and other action taken.

K. Submittals: Except for Samples intended to illustrate assembly details, workmanship, fabrication techniques, connections, operation and other characteristics, submit three (3) sets of Samples; one set will be returned marked with the action taken.
   1. Maintain sets of Samples, as returned by the Architect, at the Project Site, available for quality control comparisons throughout the course of construction activity.
   2. Unless the Architect observes noncompliance with provisions of the Contract Documents, the submittal may serve as the final submittal.
   3. Sample sets may be used to obtain final acceptance of the construction associated with each set.

L. Distribution of Samples: Prepare and distribute additional sets of Samples to subcontractors, suppliers, fabricators, manufacturers, installers, governing authorities, and others as required for performance of the Work. Show distribution on transmittal forms.
M. Field Samples specified in individual Specification Sections are special types of Samples. Comply with Sample submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

N. Retain approved Field Samples on site until completion and final acceptance or upon written approval to dispose of Field Sample from Owner or Construction Manager.

1.12 INFORMATIONAL SUBMITTALS

A. Prepare and submit Informational Submittals required by other Specification Sections.
   1. Number of Copies:
      a. Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
      b. Submit one extra set of applicable divisions and other mechanical controls-related submittals for commissioning of HVAC System.
   2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   3. Test and Inspection Reports: Comply with requirements in Division 01 Section "Quality Control".

B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

D. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

E. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

F. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

G. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating, and interpreting test results of material for compliance with requirements.

H. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
I. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating, and interpreting results of tests performed before installation of product, for compliance with performance requirements.

J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating, and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

L. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section “Contract Closeout”.

M. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

N. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement stating whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

O. Material Safety Data Sheets: Not a required submittal, nor subject to Architect’s review or approval, since Contractor remains solely responsible for job site safety controls, procedures, and programs. Submit information directly to Owner as part of Closeout Submittals unless otherwise directed. If submitted to Architect, Architect will not review this information and will return it with no action taken.

1.13 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start up, adjusting, and finishing, in quantities specified for Product Data.
B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.14 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit Manufacturers' Certification to Architect for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certifications may be recent or previous test results on material or Product, but must be acceptable to Architect.

1.15 ARCHITECT'S ACTION

A. Except for submittals for the record, for information and similar purposes, where action and return on submittals is required or requested, the Architect will review each submittal, mark with appropriate "action", and where possible return within 2 weeks of receipt. Where the submittal must be held for coordination the Architect will so advise the Contractor without delay.

1. Compliance with specified characteristics is the Contractor's responsibility, and not considered part of the Architect's review and indication of action taken.

B. Action Stamp: The Architect will stamp each submittal to be returned with a uniform, self explanatory action stamp appropriately marked and executed to indicate whether the submittal returned is for unrestricted use, final-but-restricted use, final-but-restricted use (as marked), must be revised and resubmitted (use not permitted), or without action (as explained on the transmittal form).

1. Final Unrestricted Release: Where the submittals are marked as follows, the work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents; acceptance of the work will depend on that compliance.
   a. Marking: "No Exceptions Taken"

2. Rejection: When the submittal is marked as follows, do not proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. The work covered by the submittal does not conform to design concept or meet Contract Document requirements. Do not permit submittals with this marking to be used on project site or elsewhere where project work is in progress.
   a. Marking: "Rejected" or "Submit Specified Item"

3. Final-But-Restricted Release: When submittals are marked as follows, that part of the work covered by the submittal may proceed provided it complies with both the Architect's notations or corrections on the Submittal and the requirements of the Contract Documents; final acceptance will depend on that compliance.
   a. Marking: "Make Corrections Noted"

4. Returned for Resubmittal: When submittal is marked as follows, do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations stating the reasons for returning the submittal; resubmit without delay. Repeat if necessary to obtain a different action mark. Do not permit submittals with the following mark to be used at the project site or elsewhere where work is in progress.
   a. Marking: "Revise and Resubmit"
5. Reviews by Consultants: Where submittals are marked by the Architect as indicated below, they have been reviewed by the Architect's consultant having primary responsibility for the work shown and bear the respective consultant's action markings. The Architect's marking indicates Architect's additional review that is only for areas of concern regarding aesthetic intent.
   a. Marking: "See Consultant’s Action Stamp"

6. Other Action: Where the submittal is primarily for information or record purposes, the submittal will be marked as follows:
   a. Marking: "Not reviewed".

C. Except for verification of finishes, colors and other aesthetic matters left to the Architect's discretion by the Contract Documents, Architect's review of shop drawings is only for the convenience of the Owner in following the work and shall not relieve the Contractor from responsibility for any deviations from the requirements of the Contract Documents. Architect's review shall not be construed as a complete check nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules, or from the necessity of furnishing any work required by the Contract Documents which may have been omitted on the shop drawings. Architect's review of a separate item shall not indicate review of the complete assembly in which it functions.

1.16 CONSTRUCTION PHOTOGRAPHS

A. Refer to agreement between the Owner and the Contractor for requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)
PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for schedules and reports required for performance of the work.

B. Refer also to requirements in the Agreement between the Owner and the Contractor.

C. Schedules required include:
   1. Preliminary Construction Schedule.
   2. Contractor's Construction Schedule.
   4. Unit Price Schedule.
   5. Schedule of Inspections and Tests.

D. Reports required include:
   1. Daily Construction Reports.
   2. Material location reports.
   3. Field correction reports.
   4. Special reports.

E. The Schedule of Values is included in Section 01019 - “Contract Modification Procedures”

F. Project Meeting Notes are included in Section 01039 - “Coordination and Meetings”

G. Inspection and Test Reports are included in Section 01410 - “Testing Laboratory Services”

H. Product List is included in Section 01600 - "Material and Equipment"

1.2 PRELIMINARY CONSTRUCTION SCHEDULE

A. Preliminary Network Diagram: Within the time allotted in the executed of the date established for "Commencement of the Work", submit a preliminary CPM schedule network diagram for the remainder of the Work with the preliminary diagram.
   1. Include each significant construction activity. Coordinate each activity in the network with other activities. Schedule each construction activity in proper sequence.
   2. Indicate completion of the Work in advance of the date established for Substantial Completion.

B. Submittal Tabulation: With the submittal of the Preliminary Construction Schedule, include a tabulation by date of submittals required during the first ninety (90) days of construction. List those submittals required to maintain orderly progress of the Work, and those required early because of long lead time for manufacture or fabrication.
1. At the Contractor's option, submittal dates may be shown on the schedule, in lieu of being tabulated separately.

### 1.3 CONSTRUCTION PROGRESS SCHEDULE

#### A.
Submit initial progress schedule in duplicate based on criteria required in Section 01010 Summary of Work - Work Sequence and Owner’s Schedule within the time allotted in the executed agreement for Architect review.

1. Revise and resubmit as required.
2. Submit revised schedules with each Application for Payment, identifying changes since previous version.
3. Submit a horizontal bar chart with separate line for each major section of Work or operation identifying first work day of each week.
4. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
5. Indicate estimated percentage of completion for each item of Work at each submission.
6. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and under Allowances.

#### B.
Phasing: Provide notations on the Schedule to show how the sequence of the Work is affected by the following:

1. Requirements for phased completion.
2. Limitations of continued occupancies.
3. Uninterruptible services.
4. Partial occupancy prior to Substantial Completion.
5. Site restrictions.

### 1.4 SUBMITTAL SCHEDULE

#### A.
Immediately after development and acceptance of the Contractor's Construction Schedule, prepare a complete Submittal Schedule. Submit the Schedule within the time allotted in the executed agreement of the date required for establishment of the Contractor's Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values and the list of products specified in Section "Materials and Equipment" as well as the Contractor's Construction Schedule.
2. Prepare the Schedule in chronological order: include submittals listed on the tabulation of submittals required during the first ninety (90) days of construction. Provide the following information on the Schedule:
   a. Scheduled date for the first submittal.
   b. Related Section number.
   c. Submittal category.
   d. Name of subcontractor.
   e. Description of the part of the Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date the Architect's final release or approval.

#### B.
Distribution: Following the Architect's response to initial submittal, print and distribute the Schedule to the Architect, Owner, separate Contractors, subcontractors, suppliers, fabricators, and other parties required to comply with submittal dates indicated.
1. Post copies in the Project Meeting Room and temporary field office.
2. When revisions are made, distribute the updated Schedule to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in the performance of construction activities.

C. Schedule Updating: Revise the Schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue the updated Schedule concurrently with report of each meeting.

1.5 UNIT PRICE SCHEDULE

A. Within the time allotted in the executed agreement of the date established for commencement of the Work, prepare and submit a Schedule of Unit Prices as required. Methods of measurement and pricing are specified in these sections.
   1. Refer to individual Specification Sections for portions of the Work where the establishment of unit prices required. Methods of measurement and pricing are specified in these sections.

B. Prepare the Schedule in tabular form, including the following items:
   1. Name of the part of the Work.
   2. Related Specification Section.
   3. Name of subcontractor assigned.
   4. Unit of measurement.
   5. Price per unit.
      a. Indicate whether established add-prices are different from deduct prices.

C. Distribution: Distribute to the Owner, Architect, and each party involved in performance of the portion of the Work, where established unit prices could come into force and effect.

1.6 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, test and similar services required by the Contract Documents. Submit the schedule within thirty (30) days of the date established for commencement of the Work.

B. Form: The Schedule shall be in tabular form and shall include but not be limited to the following data:
   1. Specification Section number.
   2. Description of applicable standards.
   3. Identification of applicable standards.
   4. Identification of test methods.
   5. Number of test methods.
   6. Time schedule or time span for tests.
   7. Entity responsible for performing tests.
   8. Requirements for taking Samples.
   9. Unique characteristics of each service.

C. Distribution: Distribute the Schedule to the Owner, Architect, and each party involved in performance of portions of the Work, where inspections and tests are required.
1.7 REPORTS

A. Daily Construction Reports: Prepare daily construction reports, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals, plus one copy to the Owner.
   1. List of subcontractors at the site.
   2. List of separate contractors at the site.
   3. Approximate count of personnel at the site.
   4. High and low temperatures, general weather conditions.
   5. Accidents (refer to accident reports).
   6. Meetings and significant decisions.
   7. Unusual events (refer to special reports).
   8. Stoppages, delays, shortages, losses.
   9. Meter readings and similar recordings.
  10. Emergency procedures.
  11. Orders and requests of governing authorities.
  12. Change Orders received, implemented.
  13. Services connected, disconnected.
  14. Equipment or system tests and start-ups.
  15. Partial Completions, occupancies.

B. Material Location Reports: At weekly intervals prepare a comprehensive list of materials delivered to and stored at the site. The list shall be cumulative, showing materials previously reported plus items recently delivered. Include with the list a statement of progress on and delivery dates for all materials or items of equipment being fabricated or stored away from the building site. Submit copies of the list to the Architect at weekly intervals, plus one copy to the Owner.

C. Field Correction Report: When the need to take corrective action that requires a departure from the Contract Documents arises, prepare a detailed report including a statement describing the problem and recommended changes. Indicate reasons the Contract Documents cannot be followed. Submit a copy to the Architect and to the Owner immediately.

1.8 SPECIAL REPORTS

A. General: Submit special reports directly to the Owner within one (1) day of an occurrence. Submit a copy to the Architect and other parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, prepare and submit a special report. List the chain of events, persons participating, response by the Contractor's personnel, an evaluation of the results or effects and similar pertinent information. Advise the Owner in advance when such events are known or predictable.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Gold certification based on LEED-NC, Version 3.0.

1. Other LEED prerequisites and credits needed to obtain LEED certification depend on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.

2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.

3. A copy of the LEED Project checklist is attached at the end of this Section for information only.

B. Related Sections:

1. Divisions 1 through 16 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.2 DEFINITIONS

A. LEED: Leadership in Energy & Environmental Design.

B. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

D. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
E. Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

1.3 SUBMITTALS

A. General: Submit additional LEED submittals required by other Specification Sections.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements. Highlight LEED requirements in the submittal.

C. Total Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Costs for the following categories of items are not included in Total Materials Cost Data:
   1. Furniture.
   2. Mechanical.
   3. Electrical.
   4. Specialty items such as elevators and equipment.

D. LEED Action Plans: Provide preliminary submittals within 30 calendar days of date established for the Notice to Proceed indicating how the following requirements will be met:
   1. Credit MR 2.1 and Credit MR 2.2: Waste management plan complying with Division 1 Section "Construction Waste Management."
   2. Credit MR 4.1 and Credit MR 4.2: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
   3. Credit MR 5.1 and Credit MR 5.2: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
   4. Credit MR 5.1 and Credit MR 5.2: List of proposed regionally manufactured materials and regionally extracted and manufactured materials.
      a. Identify each regionally extracted and manufactured material, including its source and cost.

E. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
   1. Credit MR 2.1 and Credit MR 2.2: Waste reduction progress reports complying with Division 1 Section "Construction Waste Management".
   2. Credit MR 4.1 and Credit MR 4.2: Recycled content.
   3. Credit MR 5.1 and Credit MR 5.2: Regionally manufactured materials and regionally extracted and manufactured materials.
F. LEED Documentation Submittals:
1. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over a period of time of not less than one year of post-construction occupancy.
2. Credit MR 2.1 and Credit MR 2.2: Comply with Division 1 Section "Construction Waste Management".
3. Credit MR 4.1 and Credit MR 4.2: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
4. Credit MR 5.1 and Credit MR 5.2: Product data indicating location of material manufacturer for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material and for each regionally extracted and manufactured material.
   a. Include statement indicating distance from manufacturer to Project for each regionally manufactured material.
   b. Include statement indicating location of and distance from Project to point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials.
5. Credit EQ 3.1:
   a. Construction indoor-air-quality management plan.
   b. Product data for temporary filtration media.
   c. Product data for filtration media used during occupancy.
   d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
6. Credit EQ 3.2:
   a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
   b. Product data for filtration media used during flush-out and during occupancy.
   c. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
7. Credit EQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.
8. Credit EQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D.
9. Credit EQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.4 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.
PART 2 - PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1 and Credit MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of cost of materials used for Project.

1. Cost of post-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.

2. Cost of pre-consumer recycled content of an item shall be determined by dividing weight of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.

3. Do not include plumbing, mechanical, and electrical components, and specialty items such as elevators and equipment in the calculation.

2.2 REGIONAL MATERIALS

A. Credit MR 5.1 and Credit MR 5.2: Provide a minimum of 20 percent of building materials (by cost) that are regional materials.

2.3 LOW-EMITTING MATERIALS

A. Credit EQ 4.1: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D:

1. Wood Glues: 30 g/L.
2. Metal to Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
20. Top and Trim Adhesive: 250 g/L.
21. Plastic Cement Welding Compounds: 250 g/L.
22. ABS Welding Compounds: 325 g/L.
23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 550 g/L.
27. ABS Welding Compounds: 400 g/L.
28. CPVC Welding Compounds: 490 g/L.
29. PVC Welding Compounds: 510 g/L.
30. Adhesive Primer for Plastic: 650 g/L.
31. Sheet Applied Rubber Lining Adhesive: 850 g/L.
32. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
33. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
34. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
35. Other Adhesives: 250 g/L.
36. Architectural Sealants: 250 g/L.
37. Nonmembrane Roof Sealants: 300 g/L.
38. Single-Ply Roof Membrane Sealants: 450 g/L.
39. Other Sealants: 420 g/L.
40. Sealant Primers for Nonporous Substrates: 250 g/L.
41. Sealant Primers for Porous Substrates: 775 g/L.
42. Modified Bituminous Sealant Primers: 500 g/L.
43. Other Sealant Primers: 750 g/L.

B. Credit EQ 4.2: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D and the following chemical restrictions:
1. Flat Paints, Coatings, and Primers: VOC not more than 50 0 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC not more than 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
6. Floor Coatings: VOC not more than 100 g/L.
7. Shellacs, Clear: VOC not more than 730 g/L.
8. Shellacs, Pigmented: VOC not more than 550 g/L.
9. Stains: VOC not more than 250 g/L.
10. Flat Interior Topcoat Paints: VOC not more than 50 0 g/L.
11. Nonflat Interior Topcoat Paints: VOC not more than 150 g/L.
12. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
13. Clear Wood Finishes, Varnishes, and Sanding Sealers: VOC not more than 350 g/L.
14. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
15. Floor Coatings: VOC not more than 100 g/L.
16. Shellacs, Clear: VOC not more than 730 g/L.
17. Shellacs, Pigmented: VOC not more than 550 g/L.
18. Stains: VOC not more than 250 g/L.
19. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
20. Dry-Fog Coatings: VOC not more than 400 g/L.
22. Pretreatment Wash Primers: VOC not more than 420 g/L.
23. **Aromatic Compounds:** Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

24. **Restricted Components:** Paints and coatings shall not contain any of the following:
   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1, 2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.
   m. Ethylbenzene.
   n. Formaldehyde.
   o. Hexavalent chromium.
   p. Isophorone.
   q. Lead.
   r. Mercury.
   s. Methyl ethyl ketone.
   t. Methyl isobutyl ketone.
   u. Methylene chloride.
   v. Naphthalene.
   w. Toluene (methylbenzene).
   x. 1, 1, 1-trichloroethane.
   y. Vinyl chloride.

C. Credit EQ 4.4: Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

**PART 3 - EXECUTION**

3.1 **MEASUREMENT AND VERIFICATION**

A. Credit EA 5: Implement measurement and verification plan consistent with Option B: Energy Conservation Measure Isolation in the EVO's "International Performance Measurement and Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction", and as further defined by the following:

B. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.

C. Evaluate energy performance and efficiency by comparing actual to predicted performance.
D. Measurement and verification period shall cover at least one year of post-construction occupancy.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2.1 and Credit MR 2.2: Comply with Division 1 Section "Construction Waste Management."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Credit EQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 1 Section "Temporary Facilities and Controls", install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
2. Replace all air filters immediately prior to occupancy.

B. Credit EQ 3.2: Comply with one of the following requirements:
1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14,400 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
2. Air-Quality Testing:
   a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED-NC: Reference Guide."
   b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
      1) Formaldehyde: 50 ppb.
      2) Particulates (PM10): 50 micrograms/cu. m.
      3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
      4) 4-Phenylecyclohexene (4-PH): 6.5 micrograms/cu. m.
      5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
   c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from same locations as in the first test.
   d. Air-sample testing shall be conducted as follows:
      1) All measurements shall be conducted prior to occupancy but during normal occupied hours and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
      2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed
furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.

3) Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.

e. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 01352
SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Quality assurance and control of installation.
B. References.
C. Field samples.
D. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

A. Section 01039 - Coordination and Meetings
B. Section 01050 - Field Engineering / Surveying
C. Section 01090 - Reference Standards.
D. Section 01300 - Submittals
E. Section 01310 - Schedules and Reports
F. Section 01410 - Testing Laboratory Services and Quality Assurance
G. Section 01600 - Material and Equipment
H. Section 01630 - Product Substitutions
I. Section 01720 - Project Record Documents

1.3 SCOPE

A. Contractor's provision and implementation of a quality control plan to assure compliance of the work of this project with the Contract Documents.
B. The work of this section is separate from and in addition to testing and inspections performed by professional laboratories hired by Owner or Contractor.
C. Requirements for testing and inspections performed by professional laboratories are specified in Section 01410 and in individual specification sections as applicable.
D. Provision of professional inspection and testing services required to verify compliance with requirements specified or indicated does not relieve the Contractor of responsibility for compliance with Contract Document requirements.
Specific quality control requirements for individual construction activities are set forth in the sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

1. Inspections, tests, and related actions specified are not intended to limit any Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

2. Requirements for the Contractor to provide quality control services required by the Architect, Owner or authorities having jurisdiction are not limited by provisions of this section.

1.4 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.5 CONTRACTOR QUALITY CONTROL

A. Provide a quality control organization and system within the Contractor's organization to perform quality control inspections, reviews, and tests for all aspects of the work, including that of subcontractors, to assure compliance of the work with Contract Documents. The Contractor's quality control system shall cover all construction operations including on-site and off-site fabrication.

B. Implement Contractor quality control through provision of a Quality Control Plan providing for effective planning and control of the following construction related activities:

1. Organization: Describe in chart form the organization of personnel assigned to and responsible for implementing Contractor's quality control plan. Describe functional responsibility of personnel assigned to quality control program and show relationship of program to site subcontractors.

2. Document Control: Describe how field design changes are identified and controlled on site to ensure only the latest approved documents are used.

3. Materials and Equipment Purchases: Describe actions to be taken to ensure that purchased materials and equipment meet specified quality levels.

4. Materials Handling, Storage, and Protection: Describe how construction materials, including architectural finish materials and other construction materials of a sensitive or non-durable nature, are to be stored, preserved, and controlled. Clearly
identify construction materials that must be specifically stored and preserved in accordance with manufacturer's recommendations.

5. **Contractor's Work:** Indicate how Contractor's work is planned and controlled to ensure that all completed work complies with the Contract Documents.

6. **Non-Conformance and Corrective Actions:** Describe how non-conformances found during inspections shall be remedied and indicate the schedule for such action.

7. **Records:** Identify quality control records considered essential to the efficient operation of the quality control plan and describe their handling. Include inspection reports and test results. Include sample reporting forms in Quality Control Plan submitted.

8. **Inspection Schedule:** Key to construction schedule and list according to specification section indicating what inspections and tests will be performed to assure Contract compliance of project construction. Include inspections and tests performed by agencies other than Contractor's forces in addition to Contractor furnished testing and inspection.

9. **Submittals Procedure:** Identify and describe procedure for reviewing submittals for Contract compliance and adherence to specification requirements to be performed prior to submittal for Architect's review.

10. **Monitor all products proposed to be incorporated into the work of this contract to warranty to the Owner as defined in Section 01740 - Warranties, that the completed work does not include any asbestos or other hazardous materials.**

C. Submit Quality Control Plan as specified within 30 days of Notice to Proceed with the work of this Contract.

### 1.6 REFERENCES

A. Conform to reference standard by date of issue current on date receiving bids establishing IGMP.

B. Obtain copies of standards when required by Contract Documents.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

### 1.7 FIELD SAMPLES

A. Install Field Samples at the site as required by individual specifications Sections for review and as directed by Owner and Architect to reflect exterior skin details, materials, etc.

B. For vertical Field Sample panels, provide supports, back-up materials, and structural framing as necessary to support the Field Sample for the duration of its use.

C. Accepted samples represent a quality level for the Work.

D. Where Field Samples are to be reviewed and accepted by the Architect, obtain Architect’s acceptance prior to proceeding with installation.

E. Where Field Sample is specified in individual Sections to be removed, clear area when instructed by Architect.
1.8 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. Submit qualifications of observer to Architect 30 days in advance of required observations. Observer subject to approval of Architect and Owner.

B. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start up of equipment, test, adjust, and balance of equipment and training as applicable, and to initiate instructions when necessary.

C. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Submit report within ten (10) working days of observation to Architect for review.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION

3.1 CONTRACTOR'S QUALITY CONTROL PLAN

A. Maintain and execute approved Contractor Quality Control Plan throughout the duration of this Contract to assure compliance of the work with the Contract Documents.

B. Provide certifications and perform inspections in accordance with requirements of related work sections and the requirements of individual technical specification sections.

END OF SECTION 01400
SECTION 01410 -

TESTING LABORATORY SERVICES AND QUALITY ASSURANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing and Inspection Agencies.
B. Description of Work
C. Qualifications of Agencies.
D. Contractor responsibilities.
E. Authority and Duties of Designated Agency Personnel
F. Reports.
G. Schedule of inspections and tests.

1.2 RELATED SECTIONS

A. Section 00220 - Geotechnical Data: Soil Investigation Information.
B. Section 00700 - General Conditions: Inspections, testing, and approvals required by public authorities.
C. Section 01019 – Contract Modification Procedures: Allowance for payment of testing services.
D. Section 01300 - Submittals: Manufacturer's certificates.
E. Section 01650 - Starting of Systems.
F. Section 01700 - Contract Closeout: Project Record Documents.
G. Division 15: Testing, adjusting, and balancing of systems.
H. Individual Specification Sections: Inspections and tests required, and standards for testing.

1.3 REFERENCES

B. ANSI/ASTM E329 - Recommended Practice for Inspection and Testing
Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.4 APPLICABLE PUBLICATIONS

A. The publication below, together with those listed in applicable Sections in Division 2, 3, and 5, form a part of this specification to the extent referenced. The publications are referred to in the rest of this Section and in other referenced Sections by basic designation only:

   b. E 165-80 Liquid Penetrant Inspection.
   c. E 709-80 Magnetic Particle Examination.

2. American Association of State Highway and Transportation Officials (AASHTO):
   AASHTO T260-84, "Method of Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials".

1.5 GENERAL REQUIREMENTS

A. Comply with provisions of following specifications, codes, and/or standards except where more stringent requirements are shown or specified:

1. ACI 301-84 (85)
2. ACI 318-89
4. PCI-MNL 616
5. AWS D1.1-88
6. AWS D1.3-81
7. AWS D1.4-79

1.6 TESTING AND INSPECTION AGENCIES

A. Testing and inspection services specified in this Section will be performed by Designated Agencies employed by the Owner. The Owner will execute contracts with those agencies on the basis of requirements of this Section and will pay those agencies directly for services performed. All other testing will be paid for by the Contractor at no expense to the Owner. Separate testing shall be subject to Architect's approval.

B. Designated Agencies and Function:

1. Geotechnical Engineer of Record who conducted foundation investigation and established foundation design criteria for the project, shall perform engineering testing and inspection of soils and foundation work as specified in this Section.

2. An Independent Testing Laboratory (ITL), designated or approved by the Owner, shall perform materials testing and inspection services,
other than those relating to soils and foundations work, as specified in this Section.

C. Designated Agencies shall perform testing and inspection services to determine compliance with requirements of the Contract Documents. Such inspections and tests shall be in accordance with Building Code, Local Authorities, State Regulations and the specifications of ASTM and other respective technical societies.

1.7 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.8 DESCRIPTION OF WORK

A. Engineering Testing and Inspection by Geotechnical Engineer shall include the following:
   1. Inspection and testing soil work in connection with building and site work excavation and fill, including subgrades below footings and floor slabs, parking lots and sidewalks, compacted fill and backfill, and soil modifications.
   2. Monitoring service, where required, to measure possible movement of existing structures that might result from excavation work on this project.
   3. Inspection of installation of foundation piers, piles, and/or footings.

B. Inspection and Testing by Independent Testing Laboratory shall include the following:
   1. Testing of materials and inspection of installation of concrete, reinforcing and embedded items of cast-in-place reinforced and/or post-tensioned concrete as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.
   2. Testing of materials and inspection of installation of materials of pre-stressed concrete by the post-tensioned method, as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.
   3. Testing of materials and inspection of installation of materials of (off-
site and on-site) pre-cast concrete work, as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.

4. Inspecting and testing structural steel as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.

5. Inspecting of steel joists and joist girders as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.

6. Inspecting and testing of metal decking and its attachments as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.

7. Inspecting and testing miscellaneous steel fabrications as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.

8. Inspecting and testing of Roofing as specified herein, or in separate sections, or as otherwise required by code, industry standard, or Owner’s direction.

C. Related Work in Other Sections: Work of this Section must be coordinated with Work of applicable Sections in Divisions 2, 3, and 5.

1.9 QUALIFICATION OF AGENCIES

A. Geotechnical Engineer:

1. Shall be the Professional Engineer that conducted foundation investigation and recommended foundation design criteria for the Project, and shall be a registered Professional Engineer in the state in which project is to be constructed and shall assume responsibility for his professional opinion of soils and foundation work.

2. Shall be qualified to supervise the soils testing program that shall be performed in a testing laboratory that satisfied requirements for Independent Testing Laboratory as specified herein.

3. Shall be qualified as a Special Inspector to perform Special Inspections on soils and earthwork where required by Building Code.

B. Independent Testing Laboratory:


2. Shall be authorized to operate in the state in which the Project is located.


4. Shall meet basic requirements of ASTM E329, including the requirement that all inspection and testing services must be under the direction of a Registered Engineer with at least five years experience in inspection and testing of construction and materials. Submit a current copy of an established Quality Assurance Manual meeting criteria of the American National Standards Institute (ANSI) N445.2
(1971) assuring that tests and/or inspections will be performed in accordance with established and accepted procedures and criteria.

5. Testing equipment shall be calibrated at maximum twelve calendar month intervals by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants. Copy of certification shall be furnished.

6. Shall submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection; with memorandum of remedies of any deficiencies reported by inspection.

7. As a minimum, all Testing Laboratory on-site supervisory personnel shall be qualified and certified in the fields of testing required for the Project, as well as metrology, as set forth in appropriate Quality Assurance and Calibration Manuals.

8. Shall be qualified as a Special Inspector to perform Special Inspections on work specified to be performed by ITL where such inspections are required by the Building Code.

9. Attend preconstruction conferences and progress meetings as required or as directed by Owner or Architect.

1.10 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with ITL personnel, provide access to Work, and to material supplier's plant and operations.

B. Provide to ITL, preliminary representative samples of materials proposed for use in the Work, in quantities sufficient for accurate testing and as specified.

C. Submit copies of mill test reports.

D. Furnish casual labor and facilities:
   1. To provide access to Work to be tested.
   2. To obtain and handle samples at the site under the direction of the ITL.
   3. To facilitate inspections and tests.

E. Notify ITL sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

F. In addition to the foregoing, the Contractor shall furnish the following:
   1. Soil survey of location of borrow soil materials, samples of existing soil materials, and delivery to the Testing Laboratory.
   2. Certification of reinforcing steel mill order.
   5. Secure and deliver to ITL, without cost, preliminary representative samples of materials proposed for use and which are required to be tested.
6. Coring and tests of below strength concrete, if ordered by the Owner or Engineer.
7. Cost of tests, when such costs are required by the Contract to be paid by Contractor.
8. Tests, samples and all costs when source of material is changed after original test or inspection has been made, to be paid by Contractor.
9. Costs of tests, samples, and field samples and mock-ups of substitute material, where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Engineer to establish equality with specified items, shall be borne by the Contractor.
10. Pay in manner directed by Owner for tests or inspections that are performed exclusively for Contractor's convenience, for such re-tests as may be occasioned by initial non-conformance of the materials with the Contract Documents and for cylinders and testing of concrete when early strength concrete is desired by the Contractor for form removal when those services are performed by ITL.
11. Provide and maintain, for the sole use of the ITL, adequate facilities for safe storage and proper curing of such test specimens which must remain on the project site prior to testing. Concrete specimens should cure 24 hours as specified under ASTM C31.
12. Retain the services of Testing Laboratory other than ITL to prepare mix designs for each type of concrete on the project. The mix designs and the cylinder tests of each type of concrete will be submitted to the ITL and the Engineer for review and approval prior to commencement of the project.

G. The Contractor shall immediately notify the ITL and the Engineer if, at any time during construction, the concrete resulting from the approved mix design proves to be unsatisfactory for any reason, such as, too much water, lack of sufficient plasticity to prevent segregation, honeycomb, etc., or insufficient strength. The ITL shall modify the design, subject to approval, until a satisfactory concrete is obtained.

H. Contractor's Obligations: Neither the observations, inspections, tests, or approvals by the Architect, Structural Engineer and/or ITL shall relieve the Contractor from his obligation to perform the Work in accordance with the Contract Documents.

I. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and as required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1.11 AUTHORITY AND DUTIES OF DESIGNATED AGENCY PERSONNEL

A. Geotechnical Engineer shall inspect and/or test soils materials, and work performed, including methods and techniques as specified for soils and foundation work, and report results to the Architect.
B. Independent Testing Laboratory shall inspect and/or test materials, assemblies, specimens, and work performed, including design mixes, methods, and techniques as specified, except for soils and foundation work, and report results to the Architect.

C. Should it appear that the material furnished or work performed by the Contractor fails to meet requirements of Contract Documents, inspector shall direct the attention of the Contractor and the Architect to such failure or infringement.

D. When requested by the Structural Engineer, the Designated Agency shall render professional opinions regarding corrective measures to construction deficiencies.

E. Designated Agencies are not authorized to revoke, alter, relax, enlarge, or release any requirement of the Contract Documents or to approve or accept any portion of the Work.

F. Laboratory may not assume any duties of Contractor.

G. Laboratory has no authority to stop the Work.

1.12 REPORTS (CERTIFICATION)

A. Designated Agencies shall submit one copy each to Structural Engineer, Architect, Contractor, and Owner of reports of tests and inspection and certification as required.

B. Within three (3) working days after tests or inspections have been made, the Designated Agency shall distribute copies of all tests and inspection reports in standard outline form to include the following:

1. Issue date
2. Project title and number
3. Testing agency name and address
4. Name of technician
5. Signature of reviewing Registered Engineer
6. Date of inspection or sampling
7. Significant meteorological conditions
8. Report number
9. Sample number
10. Location in project
11. Observations regarding compliance with contract documents

C. Field reports are to include the following items.

1. The items inspected
2. The specific location of the inspection
3. Explanation of deficiencies or substandard installations
4. Explanation of who was informed and how corrections were made
5. A statement certifying that the final inspection proved the installation to be in conformance with the Contract Documents.
D. Geotechnical Engineer:
1. Shall make soil test reports to include the following:
   a. Type of test performed, naming the standard
   b. Location of the sample
   c. Density characteristics at optimum conditions
   d. Density characteristics at field conditions
   e. Pass/fail notification of the sample
2. Shall certify that he has inspected the performance of the work by letter report, giving his opinion of the adequacy of the work, providing that all foundation excavation, preparation, operations, backfill, and compaction are done under his continuous resident inspection, and is in accordance with the plans and specifications.

E. Independent Testing Laboratory: Shall include the following in standardized form on concrete test reports:
1. Concrete design mix
2. Specified concrete strength
3. Specific location of pour
4. Placement date
5. Cylinder number
6. Slump
7. Compressive strength in psi
8. Concrete temperature
9. Concrete admixtures
10. Commentary or notes regarding departures from standard practice
11. Date of test

F. When Geotechnical Engineer and/or ITL is functioning as a Special Inspector in compliance with the Building Code, reports and notices as required by the Building Code, Chapter 52, Section 305, shall be prepared and submitted in addition to those specified herein.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 INSPECTION AND TESTING SOIL AND FOUNDATION WORK

A. The Geotechnical Engineer shall provide continuous inspection of the founding level for all proposed footing, drilling, and installation of foundation piers, and installation of compacted fill and backfill for building foundations and related walls.

B. The Geotechnical Engineer shall inspect all exposed pier excavations prior to placement of concrete and steel to verify that the supporting materials are capable of providing end bearing pressure and side bearing friction values.
used for pier design and that penetration depths are sufficient to support design loads on piers. Methods of excavation, including procedures used to maintain sidewall stability of pier holes shall be inspected by Geotechnical Engineer to verify that soil bearing and friction values have not been reduced. When the support materials and/or pier excavation depths are not adequate to provide bearing and friction values used for design, as determined by the inspection, determine the depth required to provide support for design loads and notify the Contractor. Record and report final pier depths used and variation from depths indicated on Drawings. Observe installation of reinforced concrete pier. Certify as to adequacy of completed foundation piers to support design loads.

C. Foundation Excavation:
1. All foundation excavation shall be inspected by the Geotechnical Engineer to confirm that foundation bearing materials are comparable in type and consistency to those recommended for foundation support by the subsurface investigation. The Geotechnical Engineer shall inspect the compaction operation at founding grade and shall test the results of the compaction.
2. The Geotechnical Engineer shall inspect the provisions of the Contractor to maintain and operate proper and adequate surface and subsurface drainage to satisfy the maintenance of the water level below the founding level, until the foundation excavation is backfilled.
3. Immediately prior to placing foundations on soils, the Geotechnical Engineer shall inspect the foundation subgrade. Any soil at founding level that is observed to be naturally soft, or becomes soft due to disturbance, rainwater, groundwater frost, exposure or any other cause, shall be removed to the satisfaction of the Geotechnical Engineer and replaced with concrete.
4. When requested by the Geotechnical Engineer, the Contractor shall furnish the elevations of the initially exposed subgrade and the final approved subgrade to the Geotechnical Engineer.

D. Compacted Backfill:
1. All materials proposed for backfill shall be sampled and tested by the Geotechnical Engineer for gradation by sieve analysis to confirm their suitability in accordance with the specifications. The Geotechnical Engineer shall conduct laboratory compaction tests on approved samples to define their moisture-density relationship in accordance with ASTM D-698.
2. The Geotechnical Engineer shall provide continuous inspection of the installation of compacted backfill and subsoil drains, when indicated on Contract Documents, about foundations and behind retaining walls. A sufficient number of in-place density tests shall be performed by the Geotechnical Engineer's field representative to confirm proper compaction of the backfill.

E. When required, Geotechnical Engineer shall monitor existing structures for movement that may result from excavation and construction of this project.
3.2 TESTING CONCRETE MATERIALS

A. Test normal weight aggregates by methods of sampling and testing of ASTM C33.

B. Test lightweight aggregates by methods of sampling and testing of ASTM C330.

C. Sample Portland Cement and determine properties by methods of test of ASTM C150.

3.3 DESIGN OF CONCRETE MIXES

A. Review Contractor's proposed concrete mix designs for cast-in-place concrete and pre-cast concrete that utilize materials that are indicated to comply with specified requirements by either tests or acceptable certification. Report to Architect whether or not proposed mix design meets specified requirements.

3.4 INSPECTING CONCRETE REINFORCEMENT

A. Inspect in-place reinforcement, including reinforcing bars and welded wire fabric, prior to inclusion in a concrete pour and immediately report deficiencies to Contractor, Architect, and Structural Engineer prior to concrete pour. Re-inspect corrected work. Report to Architect and Structural Engineer as to whether or not reinforcement fabrication and placement complies with drawing and specification requirements for each concrete pour.

3.5 INSPECTING CAST-IN-PLACE CONCRETE

A. Perform inspection of concrete, both architectural and structural, in accordance with ACI 311.4R.

B. Make periodic visits to batch plant and observe storage, inspect weighing and batching of controlled concrete, and make certain that materials used are in accordance with requirements of Specifications.

C. Check for adjustment in batch weights to compensate for variations in moisture content.

D. Submit promptly to Architect certification of weights used in all loads of acceptable concrete.

E. Provide a qualified inspector at site to perform following duties:
   1. Obtain a copy of batch ticket for each truckload delivered and verify compliance with design mix requirements.
   2. See that concrete is thoroughly mixed and properly placed.
   3. Perform quality control testing of concrete.
   4. Where High Range Type F or G admixture is used and added to mix at site, Inspector shall direct and supervise its use.
5. Should the Inspector, based on his observations and/or tests, be of the opinion that any load of concrete furnished to the job may not satisfy specification requirements, he shall notify the Contractor of his opinion prior to placement of said concrete into the work. If the Contractor proceeds with its placement, the Inspector shall obtain from the truck two extra standard cylinders per ASTM C31 for compressive strength evaluation of the truck load represented and shall mark on a drawing the location of placement of subject concrete in the work. A record of the extra cylinder tests and the location drawing shall be submitted to the Architect.

3.6 CAST-IN-PLACE CONCRETE FIELD QUALITY CONTROL TESTS

A. Perform the following required tests:
1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
2. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of strength test specimens.
3. Air Content: ASTM C173, volumetric method for lightweight concrete; ASTM C231, pressure method for normal weight concrete; one for every other concrete load at point of discharge, or when the indication of changes requires.
4. Strength Test Specimens: ASTM C31; one set of four (4) standard cylinders for each compressive strength test, and one set of four (4) standard beams for each flexural strength test, unless otherwise directed. Cast and store cylinders and beams for laboratory cured test specimens as specified in ASTM C31.
5. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of test specimens are made.
6. Chloride Ion Tests: Test procedures must conform to those given in AASHTO T260-84. Make a test on representative samples taken from each 500 cu. yards, or fraction thereof, of each mix design placed in any one day. Test and evaluate by the following procedure:
   a. Test individual concrete ingredients to be used in the mix or freshly mixed production concrete for total chloride ion content. If total chloride ion content, calculated on the basis of concrete proportions, does not exceed limits specified for soluble ion contents, concrete represented by test is acceptable. If test indicates that total chloride ion content exceeds limits specified for soluble ion content, proceed as follows.
   b. Test representative samples of the hardened concrete for water soluble chloride content as described in AASHTO T260-84. Evaluate concrete represented by comparing these test results with specified limits.
7. Confirm unit weight of lightweight concrete for compliance with drawings.
8. Strength Tests: Generally, comply with ASTM C39 for compressive strength tests. In addition, where specified strength exceeds 5000 psi,
take extra care in preparing and capping ends, plumbing, and testing cylinders to enable results of tests to be an accurate representation of concrete strength. Make compressive strength tests representing all concrete and one set for each 100 cu. yards, or fraction thereof, of each mix design placed in any one day or for 5000 sq. ft. of surface area placed; one specimen tested at three (3) days; one specimen tested at seven (7) days; one specimen tested at twenty-eight (28) days, and one specimen retained in reserve for later testing, if required.

   a. When the frequency of testing will provide less than five strength tests for a given mix design, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

   b. When the total quantity of a given mix design of concrete is less than 50 cu. yds., the strength tests may be waived by the Structural Engineer if, in his judgment, adequate evidence of satisfactory strength is proved.

   c. When the strength of field-cured specimens is less than 85 percent of companion laboratory-cured specimens, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

9. Report test results in writing to the Architect, Structural Engineer, Contractor, Owner, and Ready-Mix Supplier on the same day that tests are made. Report of strength tests shall contain the project identification name and number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design strength at twenty-eight days, concrete mix proportions and materials, breaking strength and type of break for the three (3) day, seven (7) day, and twenty-eight (28) day tests.

10. Laboratory report shall state whether the reported tests comply or do not comply with the specification requirements.

B. Statistical Analysis (Structural Concrete): For each class of concrete, provide a statistical analysis by computer at least once a month to indicate performance of concrete mix designs and acceptability of concrete placed.

C. Perform following additional tests:

   1. When directed by the Structural Engineer, conduct tests on in-place concrete in accordance with ACI 301, paragraph 17.3, and as specified in this Project Specification Section 03300. The Contractor shall pay for such tests when unacceptable concrete is verified.

   2. When directed by the Structural Engineer, the laboratory shall perform tests on materials used in concrete mix.

3.7 INSPECTION AND TESTING OF STRUCTURAL STEEL

A. Secure samples of structural steel (that is not identified by mill shipping statements and certified mill reports of heat and melt numbers) in sample quantities to perform structural tests on 5 percent of all such unidentified
steel. Contractor shall furnish all such material for testing and pay for all such tests.

B. ITL shall review certified mill test reports submitted by Contractor and notify Structural Engineer of any report indicating that material represented does not comply with specifications. Verify that lot numbers on tests match lot numbers of material containers on site.

C. Inspect structural steel during fabrication or before shipment for conformance with Contract Documents and approved shop drawings.

D. Inspect structural steel beams prior to shipment from fabrication plant or upon arrival at the project site for conformance with specified camber.

E. Inspect structural steel during and after erection for conformance with Contract Documents and approved shop and erection drawings. Cases of insufficient bracing, guy ing, or other unsafe conditions shall be immediately called to attention of Contractor and reported to Structural Engineer.

F. Inspect high-strength bolted connections and welded connections and perform tests and prepare test reports. State in each report whether test specimens comply with requirements and specifically state any deviations therefrom.

G. High-Strength Bolted Connections (Shop and Field):
   1. Inspect all high-strength bolted connections made in shop or field in accordance with inspection provisions of RCSC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts." Observe calibration procedures and monitor bolt installation to determine that all plies of connected material have been drawn together and that selected procedure is properly used to assure that specified pretension has been achieved in bolts.
   2. Verify that bolting crews are making a pass to bring all connections to "Snug-Tight" condition and, where "slip critical" or "tension" connections are required, another pass to bring connections to tension values shown in Table 4 of RCSC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts." In each pass, tightening of bolts should progress from most rigid part of connection to free edges.
   3. Where required, verify bolt tensions by use of a manual "inspection" torque wrench that indicates torque by means of a dial or which may be adjusted to give an indication that job inspecting torque has been reached. Job inspecting torque is determined as specified in paragraph 9 (b)(3) of RCSC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
   4. Where Alternate Fasteners are permitted to be used, the inspection torque is determined by Contractor installing the fasteners in the bolt tension calibrator and stressing it by procedure specified by Alternate Fastener manufacturer and approved by the Engineer. Then the "inspection" torque wrench is applied by the ITL to the nut in the untightening direction until tension just below the minimum tension
value in Table 4 of RCSC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts" is indicator on the calibrator. Then retighten the nut until the required minimum tension reading is observed on the calibrator. The corresponding torque value reading on the wrench becomes the inspection torque.

5. Where Direct Tension Indicators are permitted or required to be used, verify their accuracy as tension indicators by contractor installing three assemblies for each diameter and grade of bolt, nut and hardened washer and DTI in bolt tension calibrator and stress bolt to minimum specified tension in accordance with procedure specified by DTI manufacturer and approved by the Engineer. ITL then inspects gaps in DTI for compliance with specified requirements of ASTM F959 and manufacturer. Then bolt is stressed to 20 percent over minimum and ITL inspects gaps in DTI for compliance with specified requirements of ASTM F959 and manufacturer.

6. Confirm bolt tension in at least two bolts in every third connection by use of a previously calibrated "inspection" torque wrench.

7. Where Direct Tension Indicators are used, and if approved by the Structural Engineer, bolt tension may be confirmed by ITL by use of feeler gage at DTI in lieu of an "inspection" torque wrench.

8. Where high-strength fasteners have been inspected and/or tested and found to be in non-compliance, further testing by ITL and re-tightening by Contractor shall be performed in accordance with paragraph 9 (b) of RCSC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts.

H. Shop Welding: Inspect and test during fabrication of steel assemblies as follows:

1. Certify welders that are not properly certified and conduct inspections and tests as required. Record types and locations of all defects found in the work. Record work required and performed to correct deficiencies.

2. Perform visual inspection of all welds.

3. Perform tests of welds as follows:
   a. Liquid Penetrant Inspection: ASTM E165; at frequency deemed necessary by Testing Agency.
   b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not acceptable. Utilize on welds of built-up members as deemed necessary by Testing Agency.
   c. Ultrasonic Inspection: Chapters 6 and 8 of AWS D1.1. Utilize on 100 percent of shop welded moment connections and wind bracing connections and other high stress welds as determined by Testing Laboratory. Also, perform ultrasonic inspection of members within 2'-0" length on which such welds are made and check for acceptance on basis of acceptance criteria specified in ASTM A435.

I. Field Welding: Inspect and test during erection of structural steel as follows:
1. Certify welders that are not properly certified and conduct inspections and tests as required. Record types and locations of defects found in the work. Record work required and performed to correct deficiencies.

2. Perform visual inspection of all welds.

3. Perform tests of welds as follows:
   a. Liquid Penetrant Inspections: ASTM E165, at frequency deemed necessary by Testing Laboratory.
   b. Radiographic Inspection: AWS D1.1. Perform on all accessible field welded moment connections and other accessible questionable welds.
   c. Ultrasonic Inspection: Chapters 6 and 8 of AWS D1.1. Perform on field welded moment connections that inaccessible for radio-graphic inspection and other high stress welds as determined by Testing Agency.

J. Shop or Field Applied Studs: At beginning of each period of production and at beginning of production on each member that has 20 or more studs, test a minimum of two studs by striking stud with a hammer and bending it 30 degrees as per AWS D1.1. If stud weld fractures, stud is a failure and must be replaced. In the event of failure, continue to test studs while power and/or welding techniques are being adjusted until two consecutive studs pass the test.

3.8 INSPECTION OF STEEL JOISTS AND STEEL JOIST GIRDERS

A. Inspect fabrication and erection of open web steel joists and steel joist girders for conformance with Contract Documents and reviewed shop drawings.

3.9 METAL DECK ATTACHMENTS

A. Verify that metal deck is attached to the structural steel in accordance with requirements of Contract Documents and conduct welding verification tests.

3.10 WELDING OF HEADED STUD SHEAR CONNECTORS

A. Visually inspect all welded studs. Each stud should have complete fusion and weld flush or fillet for a minimum of 90 percent of its circumference and there should be no indication of lack of fusion or presence of under-cut weld. Studs not meeting this qualification upon visual inspection shall be rejected.

B. In addition to visual inspection, six members per floor shall be selected at random on which five studs shall be hammered towards the center of the member in accordance with manufacturer's recommendations, but at least until 15 degrees out of plumb. If one stud fails, all studs on the member shall be hammered and all that fail shall be replaced. For each beam with any defective studs, an additional beam shall be tested.
SECTION 01421

REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect," "requested by the Architect," and similar phrases.

D. Approved: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulations: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

G. Install: The term "install" is used to describe operations at project site including the actual "unloading, temporary storage, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
2. The term experienced, when used with the term installer, means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no choice or option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
   a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.2 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16 Division format and MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
   1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
   2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
      a. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as
if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standard in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.
   1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Researchers "Encyclopedia of Associations" or Columbia Books National Trade & Professional Associations of the U.S., which are available in most libraries.

1.4 GOVERNING REGULATIONS/AUTHORITIES

A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

1.5 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.
Testing for Indoor Air Quality, Baseline IAQ, and Materials

PART 1- GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, other Division-1 Specification sections, and specifications of materials mentioned in this section, apply to this section.

1.2 WORK INCLUDED:

A. General: This section provides (1) requirements Baseline IAQ Testing for maximum indoor pollutant concentrations for acceptance of the facility, and (2) requirements for Independent Materials Testing of specific materials anticipated to have major impact on IAQ.

B. This section specifies procedures for testing specific construction materials for Indoor Air Quality (IAQ) performance to assure compliance with EPA's IAQ program. Materials have been identified for independent testing based on the following three criteria: (1) large volume of the material used in office space, (2) the space is occupied during normal working hours, and (3) materials are used in an area where there is recirculating air.

1.3 RELATED WORK:

A. Additional specifications for baseline testing for Indoor Air Quality are included in Division 15 "Testing, Adjusting and Balancing."

B. Sequencing of installation of finish materials during construction to avoid IAQ contamination of building systems is specified in Division 1 "Sequence of Finish Installation."

C. Cleaning of HVAC system including all duct work, air intakes and returns, and changing of filters as specified in Division 15 "Testing, Adjusting and Balancing" section.

D. Manufacturer’s data shall be supplied for products, including content and outgassing of emissions as specified in Division 1 "Environmental Impact of Materials".

1.4 SUBMITTALS:

A. Baseline IAQ Testing: Submit a report for each test site specified for IAQ baseline testing as prescribed in Division 15 "Testing, Adjusting, and Balancing". Report on air concentrations of targeted pollutants as identified in Table 3.1 of this section.

B. Product Emissions Test Reports: Submit a report for each material emissions test
performed. Test results will be reported in terms of emission factors that will be used by EPA to model indoor air concentrations. These reports and the modeling data prepared by EPA shall be maintained in the Materials Log Book specified in Division 1 "Environmental Impact of Materials".

1.5 QUALITY ASSURANCE:

A. All material tests shall be performed in accordance with ASTM D 5116, "Standard Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products" (1990). Report results in accordance with Section 11 of the referenced ASTM Guide.

1.6 SEQUENCING AND SCHEDULING:

A. Identify, program, and schedule any product emissions testing well in advance of construction in a manner to prevent delays to the performance of the work of this Contract.

PART 2- PRODUCTS (Not Used)

PART 3-EXECUTION

3.1 BASELINE IAQ TESTING:

A. HVAC System Verification: To assure compliance with recognized standards for indoor air quality including ASHRAE Standard 62-1989 or latest version, the Contractor’s independent testing and balancing agency shall verify the performance of each HVAC system including space temperature and space humidity uniformity, outside air quantity, filter installation, drain pan operation, and any obvious contamination sources.

B. Indoor Air Quality Testing: Upon verification of HVAC system operation, the Contractor shall hire an independent contractor, subject to approval by the Contracting Officer’s Representative, with a minimum of 5 years experience in performing the types of testing specified herein, to test levels of indoor air contaminants for compliance with specified requirements.

1. A test plan shall be submitted for the approval of the Contracting Officer’s Representative. The plan shall specify procedures, times, instrumentation, and sampling methods that will be employed.

2. Testing will be done in 16 different locations. Contaminant levels are to be measured on each floor of each office building in an area agreed upon by the Contractor and the Contracting Officer’s Representative. Areas with very high outside air ventilation rates such as laboratories are excluded from these testing requirements. The Contracting Officer’s Representative is the sole judge of areas exempt from testing.

3. Collect air samples on three consecutive days during normal business hours (between the hours of 8:00 am and 5:00 pm) with building operating at normal HVAC rates. Average the results of each three-day test cycle to determine compliance or non-compliance of indoor air quality for each air handling zone tested.

4. Sample and record outside air levels of formaldehyde and TVOC contaminants at outside air intake of each respective air handling unit simultaneously with indoor tests to establish basis of comparison for these contaminant levels. Indoor testing will be done in the breathing
zone; between 4' and 7' from the floor.

5. Acceptance of respective portions of buildings by the Owner is subject to compliance with specified limits of indoor air quality contaminant levels.

C. Compliance Indoor air quality shall conform to the following standards and limits:

1. Carbon Monoxide: Note to exceed 9 ppm.

2. Carbon Dioxide: Not to exceed 800 ppm.

3. Airborne Mold and Mildew: Simultaneous indoor and outdoor readings.

4. Maximum Air Concentration Standards: Indoor room air concentration levels, emission rates, and qualities of the listed contaminants shall not exceed the following limits specified in Table 3.1 below.

D. Test Reports: Prepare test reports showing the results and location of each test, a summary of the HVAC operating conditions, a listing of any discrepancies and recommendations for corrective actions, if required.

1. Include certification of test equipment calibration with each test report.

E. If any test fails the standard, the Contractor is responsible to ventilate the building with 100% outside air until the building passes both air quality tests and duct inspections. Retesting shall be performed at no additional expense to the Government.

Table 3.1 MAXIMUM INDOOR AIR CONCENTRATION STANDARDS

<table>
<thead>
<tr>
<th>Indoor Contaminants</th>
<th>Allowable Air Concentration Levels*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>&lt;20 micrograms per cubic meter**</td>
</tr>
<tr>
<td>Total Volatile Organic Compounds (TVOC)</td>
<td>&lt;200 micrograms per cubic meter**</td>
</tr>
<tr>
<td>4-Phenylcyclohexene (4-PC)***</td>
<td>&lt;3 micrograms per cubic meter</td>
</tr>
<tr>
<td>Total Particulates (PM)</td>
<td>&lt;20 micrograms per cubic meter</td>
</tr>
<tr>
<td>Regulated Pollutants</td>
<td>&lt;NAAQS</td>
</tr>
</tbody>
</table>

* All levels must be achieved prior to acceptance of the building. The levels do not account for contributions from office furniture, occupants, and occupant activities.

** Above outside air concentrations.

*** 4-phenylcyclohexene is an odorous contaminant constituent in carpets with styrene-butadienelatex rubber (SBR).

TLV-TWA Threshold Limit Value - Time Weighted Average

3.2 INDEPENDENT MATERIALS TESTING:

A. Materials That Must Be Tested: All materials listed below that are proposed for use on this project shall be tested for permanent, in-place Indoor Air Quality performance in accordance with requirements of these specifications. Results shall be furnished to the Contracting Officer's Representative. Materials meeting the criteria for independent testing are as follows:

1. Field applied paint systems on appropriate substrate. Paint primers and intermediate coats (if used) should be applied with a typical drying time allowed between coats (not to exceed 7 days).

2. Carpet including manufacturer's recommended adhesive. The carpet will be applied to the appropriate concrete flooring per manufacturer's instructions so that the testing is of the "carpet assembly".

3. Ceiling tile.

4. Fireproofing material applied to appropriate substrate.

B. Materials For Testing: Only test representative samples of actual products selected for use on this project. Tests of products generically and/or technically similar but produced by a manufacturer other than that of the product selected for use on this project is invalid.

C. Materials Testing Parameters:

1. Wrap each material to be tested in air tight covering for shipment direct from the factory to the testing laboratory to avoid contamination in transit. Unwrap material or apply material to substrate if material is wet-applied, such as paint or adhesive materials) in the testing lab.

2. Emissions Testing: Perform all testing in accordance with ASTM D 5116, "Standard Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from indoor Materials/Products" (1990). Report results in accordance with Section II of referenced ASTM Guide. Report in terms of emission rates at a minimum of three distinct time intervals (e.g., 1 hour, 24 hours, 72 hours) that will be modeled by EPA to predict maximum indoor air concentrations and to assist the Contractor in determining suitability of products or materials. Assumptions that will be used for the EPA model are given below for information. This computer model will also be available to the Contractor at no cost.

3. Table 2.2 summarizes required product testing.

Table 3.2 PRODUCT EMISSION TESTING

<table>
<thead>
<tr>
<th>Product Assembly to be tested:</th>
<th>TVOC (per ASTM)</th>
<th>PM (per NIOSH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office wall paint on appropriate substrate, including any primer coat</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Carpet including adhesive and concrete flooring</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Ceiling Tile</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fireproofing material on appropriate substrate</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

D. Model Assumptions Used by EPA for Predicting Indoor Air Concentrations: The model will assume the standard room enclosure as 10' long x 10' wide x 9' high. Each product tested will be modeled separately to provide information on the particular product. The model will assume a ventilation rate of one air change per hour.

1. Field Applied Paint Systems: Test fully cured samples of each complete paint system

including primers, intermediate coats (if used), and finish coats. The model assumes
application to all four walls and one-half of ceiling of model standard room enclosure.

2. Carpet and Adhesive Assembly: Assumes application to entire 10' x 10' floor surface of
model standard room enclosure.

3. Ceiling Tile: Assumes application to entire 10' x 10' ceiling surface of model standard room
enclosure.

4. Fireproofing: Assumes application to entire 10' x 10' area above the ceiling surface of
model standard room enclosure.

E. Materials Test Reports: Submit test reports to the Contracting Officer's Representative.
The report shall include the information outlined in Section 11 of ASTM D 5116-90.

F. Product/Material Evaluation: All products/materials shown by testing to comply with
emissions limits and other criteria specified in this section will be approved for use on this
project subject to compliance with all other specified requirements of the Project Manual.
Products/materials shown by EPA's model to exceed specified emission limits shall be
discussed, test results interpreted, and a determination made as to alternative product uses
or selections.
SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Temporary electric power and light.
   3. Temporary heat.
   4. Ventilation.
   5. Telephone service.
   6. Sanitary facilities, including drinking water.
   7. Storm and sanitary sewer.

C. Support facilities include, but are not limited to, the following:
   1. Field offices and storage sheds.
   2. Temporary roads and paving.
   3. Dewatering facilities and drains.
   4. Temporary enclosures.
   5. Hoists.
   6. Temporary project identification signs and bulletin boards.
   7. Waste disposal services.
   8. Rodent and pest control.
   9. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Temporary fire protection.
   2. Barricades, warning signs, and lights.
   3. Temporary construction fencing.
   4. Environmental protection.

1.2 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
   1. Building code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, fire department, and rescue squad rules.
   5. Environmental protection regulations.

Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
2. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.3 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

B. Temporary Construction Fencing: All construction activities shall be confined within temporary construction fences. Such fencing shall be maintained intact and in first class condition at all times, including gates closed and latched.

1.4 SAFETY

A. Contractor assumes responsibility for all jobsite safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Temporary Construction Fencing: Minimum 6'-0" high chain link, with steel posts. Provide latchable and lockable gates constructed of like materials. Exact location and configuration is to be coordinated with Owner and Architect at the preconstruction meeting.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide heavy-duty, abrasion-resistant, flexible rubber hoses with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. First Aid Supplies: Comply with governing regulations.

J. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

K. Temporary Use of Permanent Heating, Cooling, and Ventilation Systems:

1. The Owner will allow use of permanent systems for construction heating, cooling, and ventilation. After all drywall and masonry work is completed inside the building, and the mechanical and electrical rooms are dry and clean, at the discretion of the Architect’s Representative, the Owner may allow the use of permanent systems. Provisions for permanent and temporary power and utilities are the responsibility of the Contractor.

2. Heat, ventilation, and cooling furnished by the permanent systems necessary for the building prior to the Owner’s acceptance of responsibility for the permanent systems is defined as temporary HVAC Work.

3. If the use of permanent systems is approved, equipment must be under control with sufficient safeties in place to prevent equipment damage and damage to building, enclosure, or building materials.

4. If the use of permanent systems is approved, provide filters for air handling units as specified in Division 15. Provide additional media sets as required during operation period.
5. If the use of permanent systems is approved, clean piping, ductwork, coils, and parts of permanent systems to the satisfaction of the Architect’s Representative before placing the permanent systems in operation for use by the Owner.

6. If the use of permanent systems is approved, warranties by the manufacturer and installer of the equipment and system components, when used for either temporary or permanent heating, cooling, or ventilation, shall commence on the Date of Substantial Completion of the Project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITIES

A. General: Engage the appropriate local utility company to connect to existing service where required. Where company provides only part of the service, provide the remainder with matching, compatible materials, and equipment. Comply with company requirements.
   1. Provide adequate capacity at each stage of construction.
   2. Use Charges: Cost or use charges for temporary utilities tied into the Owners existing services (electrical power, water gas, except Contractor's telephone service) shall be paid for by the Owner, but will not be inconvenienced by the Contractor's use. Do not permit wasteful use of utilities.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
   1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear as required.
   1. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed.

3.3 TEMPORARY SERVICES

A. Temporary Lighting: When roof deck has been installed, provide temporary lighting with local switching.
1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

B. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

C. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

D. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities. The Owner's telephones shall not be used.
   1. Separate Telephone Lines: Provide additional telephone lines for the following:
      a. Provide a dedicated telephone line for a fax machine in the field office.
   2. At each telephone, post a list of important telephone numbers.

E. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
   1. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
   2. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
   3. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

F. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.4 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
   1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.
C. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings.

D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

E. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.

F. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
   1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
   2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. or less with plywood or similar materials.
   3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
   4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

G. Project Identification and Temporary Signs: Prepare project identification and other signs as required by local, state, and federal regulations. Install signs to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.

H. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully. In addition, coordinate with Section 01524 A Construction Waste Management.

I. Rodent and Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

J. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

K. Dewatering Facilities and Drains: Comply with authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding project or adjoining properties nor endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to maintain accumulations.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
   1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
   4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
   5. Take every possible precaution to guard against and to eliminate possible fire hazards to prevent damage to the building and adjacent buildings.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

E. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

F. Site Enclosure Fence: Before construction operations begin, install chain link enclosure fence with lockable entrance gates and vinyl mesh wind screen (consult Owner on color of wind screen required). Enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
1. Set fence posts in compacted mixture of gravel and earth or driven into suitable soil to a depth required for proper support.
2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

G. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

H. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
1. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
   a. Replace air filters and clean inside of ductwork and housings.
   b. Replace significantly worn parts and parts subject to unusual operating conditions.
   c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections include the following:
   1. Division 1 Section "Construction Facilities and Temporary Controls" for environmental-protection measures during construction, and location of waste containers at Project site.
   2. Division 2 Section "Building Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
   3. Division 2 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.
   4. Division 4 Section "Unit Masonry" for disposal requirements for masonry waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE GOALS

A. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
1. Demolition Waste:
   a. Asphaltic concrete paving.
   b. Concrete.
   c. Concrete reinforcing steel.
   d. Brick.
   e. Concrete masonry units.
   f. Wood studs.
   g. Wood joists.
   h. Plywood and oriented strand board.
   i. Wood paneling.
   j. Wood trim.
   k. Structural and miscellaneous steel.
   l. Rough hardware.
   m. Roofing.
   n. Insulation.
   o. Doors and frames.
   p. Door hardware.
   q. Windows.
   r. Glazing (including mirrors).
   s. Metal studs.
   t. Gypsum board.
   u. Acoustical tile and panels.
   v. Carpet.
   w. Carpet pad.
   x. Equipment.
   y. Cabinets.
   z. Piping.
   aa. Plumbing fixtures.
   bb. Supports and hangers.
   cc. Valves.
   dd. Sprinklers.
   ee. Mechanical equipment.
   ff. Refrigerants.
   gg. Electrical conduit.
   hh. Copper wiring.
   ii. Electrical devices.
   jj. Switchgear and panelboards.
   kk. Transformers.

2. Construction Waste:
   a. Masonry and CMU.
   b. Lumber.
   c. Wood sheet materials.
   d. Wood trim.
   e. Metals.
   f. Roofing.
   g. Insulation.
   h. Carpet and pad.
   i. Gypsum board.
   j. Piping.
   k. Electrical conduit.
3. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
   a. Paper.
   b. Cardboard.
   c. Boxes.
   e. Polystyrene packaging.
   f. Wood crates.
   g. Plastic pails.

1.4 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for the Notice to Proceed.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

H. LEED Submittal: LEED letter template for Credit MR 2.1 and 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

I. 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.
J. Submittals
1. Review Submittals:
   b. Inventory of items to be removed and recycled.
2. Quality Control/Sustainable Design Submittals
   a. Reclamation agency records indicating receipt and disposition of used carpet.
   b. Certifications from Reclamation Agency and Carpet Remover that used carpet was removed and recycled/diverted from landfill.
   c. Require a standing member of Carpet America Recovery Effort (CARE) to supply weight ticket – www.carpetrecovery.org.

1.5 QUALITY ASSURANCE
A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council. Waste management coordinator may also serve as LEED coordinator.
B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN
A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total
quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.

2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.

4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

E. Forms: Prepare waste management plan on forms required for USGBC LEED online submittals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Division 1 Section "Construction Facilities and Temporary Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Sale and Donation Not permitted on Project site.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
B. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.
1. Structural Steel: Stack members according to size, type of member, and length.

E. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
1. Approved Agencies/Subcontractors:
   Carpet Removers and Carpet Reclamation Agency –
   Texas Carpet Recycling: (817)552-1011
2. Preparation:
   a. Prepare affected rooms and areas:
      1) Seal doors and openings with tape at head, jambs and sill.
      2) Use window exhaust system; establish negative pressure.
      3) Do not open windows unless exhaust fan is used.
      4) Seal exhaust system ductwork
      5) Damp mop hard surface floors daily; minimize tracking of contaminants from work area.
      6) Protect carpet with plastic and plywood; provide hard-surfaced area at entrances.
3. Carpet Removal
   a. Remove broadloom carpet in 4 foot width pieces, tightly roll, and pack in container
   b. Remove carpet tiles; palletize on maximum 36 inch pallets, maximum 4 feet high; tightly shrink wrap.
   c. Include carpet scrap and waste from new installation.
   d. Provide removal and recycling of carpet padding.
   e. Remove adhesive following recommendations of Carpet and Rug Institute (CRI).
4. Disposal
   a. Place clean, dry used carpet in containers or trailers supplied for approved by Carpet Reclamation Agency.
   b. Use effective packing techniques to maximize amount of material in container.

F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

G. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.
   1. Comply with requirements in Division 2 Sections "Trees, Shrubs and Ground Covers", and “Installation of Trees” for use of chipped organic waste as organic mulch.

C. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
      a. Comply with requirements in Division 2 Section for use of clean sawdust as organic mulch.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
      a. Comply with requirements in Division 2 Section for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed f accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Disposal: Transport waste materials off Owner's property and legally dispose of them.

C. Burning: Do not burn waste materials.
SECTION 01555
SELECTIVE CLEARING, TRANSPLANTING, PROTECTION AND MAINTENANCE
OF EXISTING TREES AND PLANTS TO REMAIN

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section includes:
1. Selected removal trees and plants not selected to remain.
2. Protection and pruning of existing trees and plants that are affected or adjacent to the Work, whether temporary or permanent construction.
3. Selected trees to be transplanted to on site locations.
   a. Selected trees as shown on the drawings shall be field dug and transplanted on campus property to locations determined by the Owner’s Representative and Landscape Architect.
4. Maintenance of existing trees to remain as shown on the drawings.
5. Warranties and Replacements.

B. Related Sections:
1. Division 1 Section "Construction Facilities and Temporary Controls" for temporary site fencing.
2. Division 31 Sections related to demolition for removing and/or protecting existing structures and other materials as required for construction.
3. Section 329300 – Trees, Shrubs and Groundcover Planting
4. Section 329350 – Landscape Establishment for 90 Days

1.3 UNIT PRICES AND PAYMENT SCHEDULE
A. Work of this Section is affected by unit prices specified in Division 1 Section "Unit Prices."
   1. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

B. Payment for this work will be Lump Sum and shall be accounted for under Landscape / Irrigation (Softscape) bid items or other item(s) as established by the Owner and General Contractor.
   1. Work and payments for the work shall be inclusive of all requirements of this section, the drawings and other specifications related to this section. The work shall be one lump sum unit, measured as completed in place and maintained tree protection for the duration of the construction activity for all trees and plants to remain.
   2. Payment shall be based on a percentage of completed work. Billing amounts may be included during progress billings as approved by the Owner’s representative and Landscape Architect

1.4 REFERENCES:
A. Definitions
1. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4-inch size, and 12 inches above the ground for trees larger than 4-inch size.
2. Drip Line of Trees: Shall be a general line projecting from the approximate furthest extending edges of the outer foliage or leaf line (canopy) of the tree or plant downward to the ground and continuous along the ground for the extent of the canopy.
3. Protection: Providing all barricades as required to prevent all damage to existing plant materials to remain, including but not limited to protection from mechanical damage, soil compaction, pollution from all sources, and disruption of environmental support which would result in the loss of vigor of said plantings.
4. Root Protection Area: The measurement of the diameter of the tree trunk in inches times a multiplier of 12. Root Protection Line may not coincide with drip line. An independent Arborist or the Arborist from the University may determine the Root Protection Area is larger or different for certain trees, specimen trees and trees with extreme exposure to construction etc.
5. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
6. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius not less than the diameter of the drip line unless otherwise indicated in the drawings.
7. Root-Ball Depth: Measured from bottom of trunk flare to the bottom of root ball.
8. Root-Ball Width: Measured horizontally across the root ball with an approximately circular form or the least dimension for non-round root balls, not necessarily centered on the tree trunk, but within tolerance according to ANSI Z60.1.
9. Root Flare: Also called "trunk flare." The area at the base of the tree's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
10. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

B. Applicable Standards: Apply standards as described in the following:
   a. Reference standards for tree balling practices for balling and transplanting selected existing trees to be relocated and for quality and standards of any replacement warranty materials.
3. ANSI - A300 Standards for Tree Care Operations
4. ANSI - A300 (Part 6) and in ANSI Z60.1 pertaining to transplanting field-grown trees.
5. Approved arboricultural recommendations which are based on the onsite tree inspection and project reports prepared by the arborist and complying with the on the above documents.
6. Tree Pruning Standards: Comply with the National Arborist Association's "Pruning Standards for Shade Trees" except where more stringent requirements are indicated.
7. Additional tree work, care and horticultural information included in these specifications

C. Regulations and Codes:
1. Work Standards and Requirements: All work shall comply with the rules and regulations of the Department of Occupational Safety and Health Administration (OSHA); The Environmental Protection Agency (EPA), State Pesticide Applicators regulations and all other local and State
agencies having jurisdiction. Nothing contained herein shall be construed as permitting work that is contrary to such rules, regulations, and codes.

1.5 SUBMITTALS

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

B. Samples for Verification: For each type of the following:
   1. Organic Mulch: 1 Quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
   2. Protection-Zone Fencing: Fencing Assembly including product information and data on all system components.

C. Qualification Data: For qualified arborist and tree service firm.

D. Final Certification: Provided by independent arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired if damaged.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

F. Existing Conditions: Documentation of existing trees and plantings indicated to remain or be transplanted, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or videotape. Color shall accurately depict hue condition of foliage and bark.
   2. Include drawings and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.6 QUALITY ASSURANCE

A. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or Registered Consulting Arborist as designated by ASCA.

B. Tree Service Qualifications: Engage an experienced tree service firm that has successfully completed tree protection extended maintenance and trimming work similar to that required for this Project and that employs an experienced, certified Arborist continuously on staff meeting Arborist Qualifications and whom actively participates in the work.

C. Tree-Transplanting Program: Prepare a written plan by arborist for transplanting trees for the whole Project, including each phase or process, tree maintenance, and protection of surrounding materials during operations. Describe in detail the materials, methods, and equipment to be used for each phase of the transplanting work.
   1. Include a transplanting schedule for each species to be transplanted, coordinated with the Project schedule.
   2. Show details of temporary protective barriers where needed.
   3. Include care and maintenance provisions.
D. Pre-installation Conference: Conduct conference at Project Site
   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
      b. Enforcing requirements for protection zones.
      c. Arborist's responsibilities.
      d. Field quality control.
      e. Plant material to be transplanted and verify site locations for the transplants.

1.7 PROJECT CONDITIONS

A. Verification of Existing Conditions:
   1. Contractor shall visit the site to determine existing conditions, including access to the site, the nature and extent of existing trees and other factors that may affect the required work.
   2. Utilities in the areas are to be confirmed through preliminary utility excavation in the areas of tree work by excavating and pot holing is required.

B. Compensation for damaged trees:
   1. The Owner shall be compensated by the Contractor for damage to existing trees designated to remain by Contractor. Unless Owner grants prior written approval, plant materials damaged or destroyed by Contractor shall be replaced by Contractor at no expense to the Owner on a caliper inch to caliper inch basis with owner’s and landscape architects option, choice and approval of replacement material.
   2. Requests for additional compensation to the Contractor resulting from the alleged ignorance of local conditions, and their effect upon the cost of the work will not be approved.

C. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
      a. Should excavation be necessary, reference the requirements for tree and root care outlined in these specifications
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

D. Do not direct vehicle or equipment exhaust toward protection zones.

E. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Adhere to the requirements in Section 329300 – Trees, Shrubs, and Groundcover Planting.
1.9 **PRELIMINARY SITE REVIEW:**

A. The Contractor shall arrange a site meeting between the Owner’s project manager and their affected department personnel and the Landscape Architect to confirm construction plans and to positively identify all trees and to be preserved and protected and materials to be removed.

B. Pre-installation Conferences:
   1. For tree removal and trimming: Before commencing tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner’s Representatives, Landscape Architect, consultants, and other concerned entities to reconfirm tree protection program. Review tree protection and trimming procedures and responsibilities. Notify participants at least 3 working days prior to convening conference.
   2. Record discussions and agreements and furnish a copy to each participant and pertinent parties concerned with the work if not in attendance.

1.10 **GENERAL PROVISIONS:**

A. All trees within the construction areas are to be identified in the field by survey ribbon tied to tree trunks in different colors for different action requirements. Flagging to be placed on the trunks of trees at chest height.

B. If any trees are found within work limits or with protection zones immediately adjacent to work which have not been indicated on the drawings or tagged, those trees shall remain until review and written instructions from the Owner or Landscape Architect for the disposition of those trees.
   1. Unmarked trees shall be brought to the attention of the Owner and Landscape Architect during the preliminary site review meeting.

C. Trees to be removed are noted on the drawings. Contractor shall mark trees to be removed using flagging. Review of marked trees shall be approved by the Owner and Landscape Architect prior to demolition.

D. Provision for access to the site for heavy equipment will be as approved by Owner. Equipment shall use prescribed roadways and shall not be allowed in areas other than designated construction areas and designated roadways. Open grass areas which are altered or disturbed by equipment during the work shall be returned by pre-existing conditions at no additional cost to Owner.

E. Debris shall become property of Contractor and shall be disposed of in accordance with local ordinances. Cost of disposal to be paid by Contractor.

F. Contractor shall protect root areas and crowns of trees not designated for work under this contract from damage from operations and equipment. The Contractor shall repair such damage at no cost to Owner. Provide fences or other barricade where necessary for such protection.

1.11 **INDEPENDENT ARBORIST REVIEWS:**

A. General Contractor to contact and hire project arborist at the commencement of the demolition and tree preservation work. Arborist shall be approved by the Landscape Architect, Owner and Landscape Contractor.
B. Arborist shall perform initial site review and assess the health and vigor of trees designated to remain and be protected, particularly in areas near construction activities.

C. Additional contract for the arborist shall include one site visit every two months for project reviews beginning one month after tree protection is in place and continuing until the date of substantial completion or as determined by the Owner’s representative and Landscape Architect.

D. General Contractor to supply copies of the arborist’s reports to Landscape Architect and to the Owner.

1.12 WARRANTY:

A. General: During the Warranty Period for new plantings, similarity warrant all existing plant materials against decline resulting from damage during construction. See Section 329300 – Tree, Shrub and Groundcover Planting.

B. Transplants:
   1. Warrant transplanting the owner’s trees that are transplanted to the effect that workmanship is warranted. The material that fails shall be replaced on a cost plus basis including supplying replacement trees that fail at contractors cost for the material and transportation plus added 15 percent profit and at no labor or equipment charge for the work to remove failed material and replace with the replacement material. Owner shall determine failed materials / lack of vigor etc. based on Section 329300 descriptions of failed plant material. Warranty for transplants shall have 1 year durations.
      a. The Owner’s representative and the Landscape Architect will review and approve suitable material for replacement. Contractor shall provide direct actual material cost including delivery tickets and freight cost for each plant submitted for replacement.
      b. Transplant Maintenance: Contractor shall monitor the transplanted trees and report on conditions of materials as a part of the 90 day Establishment Period contract as if the materials were new except that SMU will be responsible for irrigation and the contractor will monitor the moisture conditions at the trees.

C. Exclusions: Damage due to vandalism, Acts of God, failed maintenance or neglect by Owner.

1.13 REPLACEMENTS:

A. General: Existing planting to remain which exhibits conditions which are determined as unacceptable due to inadequate protection during construction shall be replaced by Contractor at no expense to Owner as outlined above.

B. Quality: Match replacements to damaged, destroyed or removed material of the same species unless otherwise approved by Landscape Architect. Submit replacement material through photographs to be approval by Landscape Architect.

C. Planting and Warranty of Replanted Materials: See Section 329300 - Planting.

1.14 MAINTENANCE AND FINAL ACCEPTANCE:

A. Reference Section 329350 - Landscape Establishment.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Reference Division 2 Sections 312220 (Landscape Finish Grading) and 329113 (Soil Preparation) regarding suitable landscape soil.

B. Organic Mulch: Reference Section 329300 Planting.

C. Protection-Zone / Tree Protection Fencing: Fencing fixed in position and meeting the following requirements.
   1. Safety: Provide all reflective signage and/or flashers as required by all codes and ordinances affecting barricaded plantings to remain.
   2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi;
      a. 48” Tensar Safety Fence or approved equal.
         1) Height: 4 feet.
         2) Color: High-visibility orange, nonfading.
   3. Provide tubular or T-shape galvanized-steel posts (Paint Pittsburg Weimer Gray as approved) and spaced not more than 8 feet apart.
   4. Provide 12 gauge galvanized wire stringer continuous at top and bottom of safety fence running along fence area.
   5. Provide with plastic bands or galvanized-steel or stainless-steel wire ties at posts and along fencing.

2.2 EQUIPMENT AND TOOLS:

A. Use only equipment that will perform the work efficiently and not cause damage to those materials designated to remain, either shown on the drawings or implied herein.
   1. Air Spade: Air operated trenching and excavation tool connected to suitable high output air compressor. The air spade is suitable and is required for root mass and root crown investigation and for excavation for foundations and utilities or other improvements that must cross specimen tree root protection zones.
   2. Pruning Tools: Shall be of good quality and working condition, sharp, and of the approved type for arboricultural work.

2.3 SHARP SAND:

A. ASTM C-33 for fine aggregate.

2.4 TREE PAINT:

A. Not used unless required by the arborist for special conditions.

2.5 ANTISEPTIC:

A. Antiseptic shall consist of a mixture of bleach and water as recommended by the arborist.
1. Disinfect pruning equipment between trees with a mixture of 1 part bleach with 5 parts water mixture, wipe tools dry before moving to next pruning area with clean towels or cloths.

2.6 INSECTICIDE:
   A. Material as suitable for the insect or pest being controlled and approved by the USDA/EPA.
   B. Refer to Arborist report and recommendations for insecticides:
      1. Materials deemed necessary and for rate of application.
      2. Recommendations for treatment of other pests and disease

2.7 FERTILIZER:
   A. Refer to Arborist Report for recommendation of application.
   B. Refer to Section 329113 and 329350 for other fertilization materials and requirements.

2.8 WATER:
   A. Clean fresh water, potable at the source, suitable for irrigation. Furnish, transport and apply as required.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not pond or erode protection zones. Provide grading and erosion control as approved to correct such conditions.
   B. Locate and verify existing utilities, irrigation and other items to remain, investigate record drawings and other Owner available records. Pothole excavations to verify locations before equipment commences.
   C. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION
   A. Locate and clearly identify trees, shrubs, and other vegetation to remain, to be removed or to be transplanted. Tie an identifying surveyors ribbon around each tree using a different color or sets of colors. Tie ribbons to each tree trunk at approximately 54 inches above the ground.
   B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations. Areas surrounding trees should slope to drain water away or out of the root protection zone.
3.3 **TREE PROTECTION:**

A. All trees to be preserved on the property shall be protected against damage during construction operations by fencing as shown; subject to the approval of the Owner. The tree protection shall be placed before any excavating or grading is begun and maintained in repair for the duration of the construction work unless otherwise directed. No material shall be stored or construction operation shall be carried on within a distance as shown of any tree to be saved or within the tree protection fencing. Tree protection shall remain until all work is completed.

B. Any damage to existing tree crowns or root systems shall be repaired immediately by an approved tree surgeon at the Owner's direction. Roots exposed and/or damaged during demolition and/or grading operations shall be cut off cleanly inside the exposed or damaged area with the topsoil and mulch placed over the exposed root area immediately. The Owner shall have his representative present on the site to observe these operations.

C. Provide fencing, barricades, or other suitable guards located outside the drip line (outer perimeter of branches) to protect remaining trees and other plants from damage. Provide barriers at the drip line of all trees designated to remain. Grouping of trees may be encircled by a single protective fence.
   1. Follow same requirement for trees to be transplanted except barriers may be removed as trees are relocated to new positions.

D. Protect tree root systems from damage due to noxious materials caused by run-off or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

E. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line, and prevent soil compaction over root systems.

F. Parking for construction workers shall not be permitted within tree protection zones and shall be strictly enforced.

3.4 **TREE- AND PLANT-PROTECTION ZONES**

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by established maintenance gates within the fencing. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Location of fencing shall be staked in the field prior to construction of fencing and approved by the Owner and the Landscape Architect.
   2. In general, fences and barricades are intended to alert those working on the project that equipment and machinery are not to be stored or operated in the feeder root zone. Where not shown, the fences and barricades shall be placed not closer than nine (9x) times the caliper of the tree to the tree, or at the drip line. The exact location of fences or barricades shall be determined by the Landscape Architect.
   3. Posts shall be installed plumb and rails level, and as approved.
4. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
5. Access Gates: Install in panels. Purpose is for temporary access, inspection and maintenance.

B. Maintain protection zones free of weeds and trash.

C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.5 MULCH COVERING:

A. Tree-Protection Zones: Mulch areas inside tree-protection zones which are not covered with permanent turf grass. A portion of the area may be mulch and grass mixture. If turf remains, contractor shall maintain as turf.
   1. Apply 3 inch average thickness of organic mulch. Do not place mulch within 24 inches of tree trunks.

3.6 SELECTIVE CLEARING IN GENERAL AREAS:

A. Remove only those trees and plants designated on the plans or as identified during the preliminary site review meeting.

B. Vegetation and Tree Removal: Remove and legally dispose of:
   1. 12 inch caliper and smaller trees: All above ground portions the tree including branches and foliage and the below grade stump / root system for a dimension approximately 1 ½ times the diameter of the trunk/
   2. 12 1/2 inch caliper and larger trees: Same as 12 inch except where root system does not conflict with project improvements, the root system and stump may be ground with the top of the root remaining at a minimum of 15 inches below grade and all associated grinding matter to be removed. Contractor has the option to also remove the root system as outlined above.
   3. Shrubs: Same as 12” caliper trees.
   4. Groundcover, Lawn and similar low vegetation: Strip vegetation from the ground plus not less than 1 inch of surface soil to be removed. In areas of construction, additional removal will be a requirement of other construction and demolition or may be included in Civil specifications or scoped as work by others.

3.7 EXCAVATING AND MINOR REGRADING:

A. Do not excavate within tree drip line, unless otherwise indicated.
B. Cut: Do not permit machine excavation within the drip line of existing trees to remain. All such work shall by Air Spade and hand labor. Do not permit more than two (2) inches of existing soil to be removed within the drip line except as authorized in writing by the Independent Arborist and Landscape Architect.

C. Fill: Do not permit stockpiling of soil within the drip line of all existing trees. Do not permit more than three (3) inches of fill to be placed within the drip line during grading operations without written acceptance of the Independent Arborist and Landscape Architect.
   1. If approved, temporary or permanent fill shall be limited to an allowable encroachment zone at a maximum of 25 percent onto the exterior side of the root protection zone.

D. Where excavation for new construction is required within tree drip lines, hand excavate to minimize damage to root systems. Use and Air Spade and narrow-tine spading forks and remove and comb soil to expose roots.
   1. Relocate roots in backfill areas wherever possible. If encountering large, main lateral roots, expose beyond excavation limits as required bending and relocating without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction as described in Root Pruning article.
   2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition and temporarily support and protect roots from damage until they are permanently relocated and covered with earth.

3.8 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
   1. Cut roots manually by digging a trench with the Air Spade and selectively cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   2. Cut Ends: Do not paint cut root ends
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   4. Cover exposed roots with burlap and water regularly.
   5. Backfill as soon as possible according to requirements in Division 31 Sections for Landscape Finish Grading and Civil Engineers "Earthwork."

B. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

C. Treat cut roots after cutting according to arborist recommendations. Disinfect pruning equipment between trees with antiseptic mixture and wipe tools dry with clean towels or cloths before moving to next pruning area.

D. Fill excavations to existing finished grade with approved loamy soil, compact according to Division 2 requirements in lifts, watering each lift thoroughly
3.9 PRUNING: (N.A.A. STANDARDS)

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
   1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
   2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
   3. Cut branches with sharp pruning instruments; do not break or chop.
   4. Do not apply pruning paint to wounds.

B. Chip removed branches and dispose of off-site.

C. All cuts shall be made sufficiently close to the trunk or parent limb, without cutting into the branch collar or leaving a protruding stub, so that closure can readily start under normal conditions.

D. It is necessary to precut branches too heavy to handle to prevent splitting or peeling the bark. Where necessary, to prevent tree or property damage, branches shall be lowered to the ground by proper ropes or equipment. Remove the weaker or least desirable or crossed or rubbing branches. Such removal should not leave large holes in the general outline of the tree.

E. Treatment of cuts and wounds, with tree wound dressing is optional except where open wounds in certain trees may attract insects that carry disease or allow fungus invasion. If such treatment is made, materials non-toxic to the cambium layer must be used, and care taken to treat only the exposed wood with a thin coat of dressing.

F. Old injuries are to be inspected. Those not closing properly and where the callus growth is not already completely established should be traced where appropriate. If desired, for cosmetic purposes, the wound may be treated with a thin coat of wound dressing.

G. In reducing overall size, attention is to be given to the symmetrical appearance. Top is to be higher and sides reduced in order to maintain a tree-like form. All effort should be made to cut back to a lateral, one-third of the diameter of the cut being made.

H. When cutting back trees, just enough limbs shall be removed to get the effect wanted without admitting too much sunlight to the trunk of the tree or the top of large branches. Care should be taken with maples, oaks, and other thin barked trees susceptible to sunscald. Damage may be minimized by doing work on susceptible species during the dormant season.

I. In lifting the lower bottom branches of trees for clearance, care should be given to symmetrical appearance, and cuts should not be made so large that they will prevent normal sap flow and they should allow water to drain.

J. Prune as required and as directed by the Arborist. Pruning shall take no more than one-quarter of root and crown system except by special direction of Arborist and as confirmed by the Owner’s Representative and the Landscape Architect.

K. Use clean, sharp tools, disinfect where necessary to prevent spread of disease.
L. Limbs and debris from this work shall be transported and not dragged over the site. Wood and debris shall become property of Contractor and shall be removed from site and legally disposed of in accordance with local ordinances. Cost of disposal to be paid by Contractor.

3.10 TRANSPANTING
1. Dig exploratory pits or trench by hand around perimeter of tree at indicated root-ball width to determine locations of main lateral roots.
2. Dig trench around perimeter of tree at indicated root-ball width to the depth of the root system. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
3. Root-Ball Width: Minimum 10 inches of root-ball diameter, or least dimension for non-round root balls, for each 1 inch of tree caliper being transplanted.
4. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking.
5. Verify proper moisture content of soil, if material is too wet or dry the soil could crack or fail during balling.
6. Cut exposed roots manually with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
7. Do not paint or apply sealants on cut root ends.
8. While tree is in the hole, wrap the sides of the tree tightly with burlap and pin the material using #6 or similar size box nails to suitably tighten the burlap and hold soil securely in the balled form.
9. When the ball is secured, tilt the partially balled tree and cut bottom roots to create a flat bottom ball. Complete balling with burlap and secure the bottom and sides together with burlap.
a. If necessary provide temporary wire reinforcement if necessary or tie with 3/16 diameter manila rope ties.
10. Carefully load the ball for transport according to Section 329300 and transport to designated location, follow with planting according to Section 329300.

3.11 REGRADING
A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beginning beyond the protection zone. Maintain existing grades within the protection zone.
1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or tap roots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

3.12 REMOVAL OF TREE INFECTED BY HYPOXYLON CANKER:
A. Arborist Report shall identify any trees infected.
1. Contractor to remove designated trees from site and dispose in accordance with local ordinances.

3.13 TREE PRUNING WORKMANSHIP:
A. Pruning work shall be performed by personnel trained and experienced in this work and shall be done under the direction of a qualified forester or arborist on Contractor's staff.
B. Pruning work shall be performed in conformance with recognized horticultural and arboricultural practices. Where job requirements require deviation from normal practice, obtain approval.

3.14 **BORER PROTECTION:**

A. At the direction of the project arborist and with the approval from the Owner apply specified insecticide at the rate prescribed by the project arborist.

3.15 **APPLICATION OF TREE FERTILIZER:**

A. Shall be done at the direction of the arborist with approval by the Owner and the Landscape Architect.

3.16 **MAINTENANCE OF EXISTING TREES AND PLANTING:**

A. General: During the Construction Period maintain all existing plantings to remain. See Section 329350 - Landscape Establishment.

B. Trees and planting near buildings, roads, paths, in view corridors and other prominent locations shall receive added maintenance to include watering, disease and pest control, fertilization, and regular washing for dust control. Dust shall not be allowed to accumulate more than weekly on any trees.

C. Watering Maintenance: Shall include supplemental watering by hand or otherwise. Material shall be watered on whatever frequency is required to maintain adequate moisture in the root zone with approval of from the project arborist.

D. Fertilizers: Do not use complete fertilizers on existing plant materials unless soils test indicates specific nutrient deficiencies. Use only with approval from the project arborist.

E. Dust accumulation: During excessively dry or dusty conditions, tree foliage shall be rinsed to remove excess dust on an as needed basis.

3.17 **FIELD QUALITY CONTROL**

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.18 **REPAIR AND REPLACEMENT**

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
3. Perform repairs within 24 hours.
4. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

3.19 **DISPOSAL OF SURPLUS AND WASTE MATERIALS**

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Protection of existing trees scheduled to remain including supplementary items
      necessary to complete and maintain the protection barricade installation.

B. Related Sections:
   1. Section 02200 – Building earthwork

1.2 SITE CONDITIONS
A. The existing trees are located on the drawings. Protect these trees and all other trees
   outside of the building footprint unless they are scheduled to be removed.

1.3 TREE TAGGING
A. Identify trees to be preserved with permanent flagging tape.

1.4 PROTECTION
A. Protect trees by barricading each tree or group of trees outlined on the drawings.
B. Do not cut or fill within the line of the barricade or within the drip line of the trees.
C. Complete protection fencing as part of site mobilization.

1.5 GUARANTEE
A. Guarantee existing trees against damage until final acceptance of the project. Repair any
   damage which, in the opinion of the landscape architect, can be satisfactorily corrected.
B. Trees damaged during construction activities are subject to penalties as noted herein.

1.6 DEFINITIONS
A. Disturbance/Damage: Physical or visual change to the trees which, in the opinion of the
   landscape architect, are detrimental to the trees being protected. Such disturbance may be
   caused by equipment, material, or personnel.
B. Violation: Damage to trees caused by any construction or delivery vehicle, construction
   material storage, or disposal of solid or liquid debris shall be considered a violation.
PART 2 - PRODUCTS

2.1 BARRICADES

A. Fence Material: 9 ga. galvanized chain link fencing, 6'-0" tall.

B. Post: Galvanized steel posts 2” o.d.

PART 3 - EXECUTION

3.1 TREE PROTECTION

A. Barricade: Install barricades around trees at their drip line and as shown on drawings. Do not modify fence location unless otherwise approved by architect.

3.2 MAINTENANCE

A. Maintain tree protection barricades in a newly installed condition through substantial completion or until construction has been completed in the area of the tree(s).

B. Deep-water protected trees weekly during dry periods, and spray tree crowns periodically to reduce dust accumulation on the leaves.

3.3 PENALTY

A. If any tree is damaged and, in the opinion of the landscape architect, cannot be satisfactorily repaired, then a fine of $150 per caliper inch will be assessed against the contractor. Caliper measurements will be taken as follows: up to and including 4" caliper, 6" above ground level; trees over 4" caliper, 4'-0" above ground level.

B. If the landscape architect agrees that the damage can be satisfactorily repaired, then complete this work by a qualified arborist to the satisfaction of the owner/landscape architect.
SECTION 01565

POLLUTION PREVENTION AND CONTROL

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Storm Water Pollution Prevention and Pollution Control Plan as required by the Texas Commission on Environmental Quality (TCEQ) effective March 6, 2003.

1.2 QUALITY ASSURANCE
A. State Standards: Execution of the Pollution Prevention and the Pollution Control Plan shall meet all requirements set forth by the TCEQ under the Texas Pollution Discharge Elimination System (TPDES) regulations.

1.3 SUBMITTALS
A. Contractor shall submit a signed and filed copy of the NOI prior to the start of construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PERFORMANCE
A. The Owner shall submit the formal SWPPP document per TCEQ TPDES permit TXR 150000. The Owner is responsible for all associated fees for compiling and submitting the SWPPP. The Contractor shall be given a copy of the SWPPP by the Owner. Contractor is the construction operator for the Storm Water Pollution Prevention Plan (SWPPP).

B. Implement all the requirements detailed in the Storm Water Pollution Prevention Plan and any additional pollution prevention and control measures required by the TCEQ.

C. The Erosion Control Plan is included as part of the construction plans. The erosion control plan provided in the construction plans is a guide for the contractor but shall be updated and amended as necessary. The SWPPP will be delivered to the Contractor at the pre-construction meeting.

D. Contractor shall notify the MS4, known on this project as the City of University Park, two days prior to construction activities.

E. Contractor shall post the Site Notice on the job site in accordance with TCEQ guidelines.

F. Contact the City for copies of all documents necessary to compliance.
G. Contractor shall perform all required inspection control measures in the SWPPP.

H. Contractor shall be totally responsible for conducting storm water management procedures in accordance with TPDES permit and for enforcement taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from the Contractor’s failure to comply with portions of the TPDES permit.

END OF SECTION 01565
SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Products: This section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. Product delivery and handling.

C. Storage and protection.

D. Product selection.

1.2 RELATED SECTIONS

A. Section 01630 - Product Substitutions: Requests for substitutions requirements.

B. Section 01400 Quality Control: Product quality monitoring.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.

1. "Products" is defined as new materials, machinery, components, fixtures, and systems forming the Work. "Products" do not include machinery and equipment used in preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials and/or components required for reuse or reinstallation. "Products" are items purchased for incorporation in the Work, whether purchased for the Product or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

3. "Equipment", is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.
1.4 SUBMITTALS

A. Product List Schedule: Prepare a schedule showing products specified, in a tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1. Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.

2. Forms: Prepare the product listing schedule with information on each item tabulated under the following column headings:
   a. Related Specification Section number.
   b. Generic name used in Contract Documents.
   c. Proprietary name, model number and similar designations.
   d. Manufacturer's name and address.
   e. Supplier's name and address.
   f. Projected delivery date, or time span of delivery period.

3. Initial Submittal: Within thirty (30) days after date of commencement of the Work, submit three (3) copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

4. Completed Schedule: Within sixty (60) days after date of commencement of the Work, submit three (3) copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

5. Architect's Action: The Architect will respond in writing to the Contractor within ten (10) days of receipt of the completed product list schedule. The Architect's response will include the following:
   a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.
   b. A request for additional data necessary for the review and possible acceptance of the products and manufacturers listed.

1.5 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Architect's approval required wherever the terms "or equal", or "or approved equal", or "as or equal to" are used in specifying products and/or naming manufacturers in the equality/acceptability of products/manufacturers submitted as equals to specified products/manufacturers.
D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces or products, which will be exposed to view in occupied spaces or not the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface, which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.

1.6 PRODUCT DELIVERY AND HANDLING

A. Deliver and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
5. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.7 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturers' recommendations, with seals and labels intact and legible. Use means and methods that will prevent damage, deterioration, and loss including theft.

B. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

C. Store products subject to damage or deterioration by the elements above ground, under cover in a weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

D. For exterior storage of fabricated products, place on sloped supports, above ground.

E. Provide bonded off site storage and protection when site does not permit on site storage or protection.
F. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of Products to permit access for inspection and measurement of quantity or counting of units. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
   1. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
      a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
   2. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
   3. Non-Proprietary Specification Requirements: Where one or more products or manufacturers are specified by name. Products of named manufacturers that meet specifications. Comply with Contract Document Section 01630 - Products Substitutions provisions concerning "substitutions" to obtain approval for use of an unnamed manufacturer or product.
   4. Products Specified by Naming One or More Manufacturers with a Provision for No Substitutions Allowed: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
   5. Compliance with Standards, Codes, and Regulations: Where the Specifications require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
   6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600
1.1 SUMMARY
A. Administrative and procedural requirements for handling Contractor requests for substitutions made during the negotiations period or after award of the Contract.

B. Substitution requests will not be reviewed if submitted less than twelve (12) calendar days prior to the bid date unless it is determined to be a benefit to the Owner to consider such request.

C. Standards: Refer to Section 01090 for applicability of industry standards to products specified.

1.2 RELATED SECTIONS
A. Section 01600 – Materials and Equipment: Procedural requirements governing the Contractor’s selection of products and products options.

B. Section 01601 – Contractor’s Request for Substitution Form: Form required for substitution requests.

1.3 DEFINITIONS
A. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contract after the bidding period are considered requests for "substitutions”. The following are not considered substitutions:
   1. Revisions to Contract Documents requested by the Owner or Architect.
   2. Specified options of products and construction methods included in Contract Documents.
   3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS
A. Substitutions During The Bidding Process
   1. Bids shall be submitted only on the basis of materials, products, and equipment specified in the Specifications, indicated on the Drawings, or as named by Addenda pursuant to approval of requests for Substitutions.
   2. Materials, products, and equipment included in the Bidding Documents are specified for the purpose of establishing a minimum standard of quality, cost, appearance, design, and function. It is not the intent to limit the acceptance of materials, products, or equipment specified, but rather to name or describe a material, product or piece of equipment as the absolute minimum standard that is desired and acceptable. Where proprietary names are used, whether or not followed by the
words “or equivalent”, requests for substitutions will nevertheless be considered if properly submitted to and received by the Architect prior to the designated date.

3. If any Bidder wishes to substitute equipment or materials, which is believed to be equal to those specified, the Bidder shall make a request in writing to the Architect for approval of such substitute equipment or materials at least ten (10) calendar days prior to the date for receipt of Bids, following the rules stated herein. If the Architect should approve of such substitute equipment or materials, an Addendum evidencing such approval will be prepared by the Architect and issued to all prospective Prime Bidders of whom the Architect has a record.

4. All requests for substitutions shall be accompanied by manufacturer’s product data, specifications, drawings, catalog cuts, samples, installation instructions, performance data, and other reference and information necessary to completely describe the item, and to facilitate a thorough and complete review by the Architect. Requests not meeting all these requirements may be rejected without evaluation.

5. The Substitution Request Form included as an attachment to this document shall be used for all Substitution requests. Failure to use the attached form or the failure of the Bidder to fully execute the form as required, may result in rejection of the proposed substitution without review.

6. Manufacturers, manufacturer’s representatives, dealers, distributors, suppliers, and subcontractors shall not direct or make requests to substitute equipment or materials. All requests shall originate from a Prime Bidder.

7. Substitutions shall be submitted to the Architect only; no substitutions shall be submitted directly to any consultant, the Owner, or any of the Owner’s consultants.

B. Substitutions after Award of Contract

1. Substitutions Request Submittal: Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
   a. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required by Section 01601. Limit each request to one proposed substitution.
   b. Architect's Action: Within seven (7) calendar days of receipt of the Request for Substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within seven (7) calendar days of receipt of the request, or seven (7) calendar days of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution requested will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.
3. The request is timely, fully documented, and properly submitted.
4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data, or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

2.2 ACCEPTANCE

A. Acceptance of substituted materials by the Owner and Architect constitutes a representation that:
   1. Accepted substitutions requested by the General Contractor remains his responsibility and he alone shall be responsible for the correct function, operation, performance, and accommodation of other listed articles, materials and equipment.
   2. The General Contractor shall bear all costs associated and in conjunction with any and all changes arising out of the use of the substituted materials and/or equipment.

PART 3 - EXECUTION

3.1 APPROVED SUBSTITUTIONS DURING THE BIDDING PROCESS

A. The Architect will issue an Addendum if the Request for Substitution is submitted and approved within the time allotted.

B. If it is determined by the Architect, after consultation with the Owner, that a Request for Substitution which is submitted beyond the time allotted is a benefit to the Owner, the Architect will issue an Addendum to the project.
3.2 SUBSTITUTIONS AFTER AWARD OF CONTRACT

A. Form of Acceptance: A Change Order will be issued by the Architect if the approved Request for Substitution affects the Contract Construction Cost or the Construction Schedule.

B. If Architect cannot make a decision on use of a proposed substitution within time allocated, or if substitution request is rejected, provide the basis of design product originally specified.

C. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall remove the substituted product, material, or item and provide the originally-specified product at no additional cost to Owner.

END OF SECTION 01630
SECTION 01631

SUBSTITUTION REQUEST FORM

PART 1 - GENERAL

1.1 SUMMARY

A. Substitution requests will not be reviewed if submitted less than twelve (12) calendar days prior to the bid date.

B. The Contract Sum proposed by the undersigned is for the Work as shown on the Drawings, described in the Specifications, and otherwise defined in the Contract Documents and the Agreement between the Owner and the Contractor. However, the undersigned proposes the following substitutions for the Owner's consideration. Should the Owner accept any or all of the proposed substitutions, the proposed Contract Sum will be adjusted by the amount shown.

1.2 RELATED INFORMATION SPECIFIED ELSEWHERE

A. Section 01600 - Material and Equipment

B. Section 01631 – Product Substitutions

1.3 COMPARATIVE INFORMATION

A. Provide complete comparative information as required and described in Section 01600 - Material and Equipment for review by Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF PROPOSED SUBSTITUTIONS

A. Prepare a separate form with the following information for each proposed substitution. (Submit 3 copies)

1. Date: ____________

2. Request No. : ______

3. To: ______________ c/o [INSERT CONSULTANT FIRM]

4. Project: ______________ Project Number: ______

5. Name and Address of General Contractor: ________________________________

Hereby requests review of the following product or systems as an acceptable substitution.
6. Name and Description of Specified Product or System:

7. Specification Section No.: _____ Page(s): _______ Paragraph(s): _______

8. Drawing No.(s): _____________ Detail or Section No.(s) ______

9. Substitution Comparison:

<table>
<thead>
<tr>
<th>SPECIFIED PRODUCT</th>
<th>SUBSTITUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name, Brand:</td>
<td></td>
</tr>
<tr>
<td>Catalog No.:</td>
<td></td>
</tr>
<tr>
<td>Manufacture:</td>
<td></td>
</tr>
<tr>
<td>Vendor:</td>
<td></td>
</tr>
<tr>
<td>Variations:</td>
<td></td>
</tr>
<tr>
<td>Maintenance Service Available:</td>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>

Spare Parts Source: __________________________

10. Name of Manufacturer: __________________________

11. Address: __________________________

12. Telephone: __________________________

13. Name of Vendor: __________________________

14. Address: __________________________

15. Telephone: __________________________

16. What affect does substitution have on applicable code requirements? ______

17. Differences between proposed substitution and specified item? ____________________________

18. Manufacturer's guarantees of the proposed and specified items are:
   ___ Same
   ___ Different (explain on attachment)

19. Reason for not giving priority to specified items: ____________________________
20. Substitution affects other materials or systems:

___ Yes (If yes, attach complete data)
___ No

21. Substitution request requires dimensional revision or redesign of structure or M & E work:

___ Yes (If yes, attach complete data)
___ No

22. Substitution affects the construction schedule:

___ Yes, (If yes, explain affect): ____________________________________________
___ No

23. Saving or credit to Owner for accepting substitute:

$ ____________________________________________

24. Cost or debit to Owner for accepting substitute:

$ ____________________________________________

25. Backup Information:

___ Catalog, ___ Drawings, ___ Samples, ___ Tests, ___ Reports

Other (list) ____________________________________________

26. CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENTS

I/we have investigated the proposed substitution. I/we:

A. believe that it is equal or superior in all respects to specified product, except as stated above;
B. will provide same warranty as specified for specified product, except as stated above;
C. have included complete cost data and implications of the substitution:
D. will pay redesign and special inspection costs caused by the use of this product;
E. will pay additional costs incurred by other contractors caused by the substitution;
F. will coordinate the incorporation of the proposed substitution into the Work;
G. will modify other parts of the Work as may be necessary to fully integrate the substitution into the Work;

H. waive future claims for added cost or time extension to Contract caused by the substitution.

Submitted by: ___________________________________________________________

Signature: __________________________ Date: ________________

Title: _________________________________________________________________

Firm: _________________________________________________________________

Address: _____________________________________________________________

Telephone: __________________________ Fax: _____________________________

All questions must be answered and all blanks filled in. Enter "NA" if not applicable. Unresponsive or incomplete requests will be rejected and returned without review.

☐ Product data for proposed substitution is attached (description of product, reference standards, performance, and test data).

☐ Sample is attached. ☐ Sample will be sent if requested.

REMARKS:

Accepted ____ Accepted as Noted ____ Not Accepted ____ Received Too Late ____

By: _________________________________________________________________

Signature: __________________________ Date: ________________

Title: _________________________________________________________________

Firm: _________________________________________________________________

Address: _____________________________________________________________

Telephone: __________________________ Fax: _____________________________

REMARKS:
SECTION 01650

STARTING OF SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Starting systems.
B. Demonstration and instructions.
C. Testing, adjusting, and balancing.

1.2 RELATED SECTIONS

A. Section 01400  Quality Control: Manufacturer’s field reports.
B. Section 01700  Contract Closeout: System operation and maintenance data and extra materials.
C. Division 15: System commissioning.
D. Division 16: System commissioning.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start up of various equipment and systems.
B. Notify Owner and Architect in writing seven (7) days prior to start up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify wiring and support components for equipment are complete and tested.
F. Execute start up under supervision of responsible manufacturer’s representative and Contractor’s personnel as required in accordance with manufacturer’s instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start up, and to supervise placing equipment or system in operation.
H. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.
1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

C. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owner’s personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at equipment location.

E. Prepare and insert additional data in Operations and Maintenance Manuals when need for additional data becomes apparent during instruction.

1.5 TESTING, ADJUSTING, AND BALANCING

A. Owner will appoint, employ, and pay for services of an independent firm to perform testing, adjusting and balancing.

B. The independent firm will perform services specified in Division 15.

C. Reports will be submitted by the independent firm to the Architect indicating observations and results of tests and indicating compliance or non compliance with specified requirements and with the requirements of the Contract Documents.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)
SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. Closeout procedures.
B. Contractor-prepared Punch List.
C. Final cleaning.
D. Adjusting.
E. Spare parts and maintenance materials.
F. Closeout requirements for specific construction activities are included in the appropriate specification sections.

1.2 RELATED SECTIONS

A. Section 01500 Construction Facilities and Temporary Controls: Progress cleaning.
B. Section 01650 Starting of Systems: System start up, testing, adjusting, and balancing.
C. Section 01720 – Project Record Documents: Contract closeout submittals.
D. Section 01730 Operation and Maintenance Data: Contract closeout submittals.
E. Section 01740 Warranties: Contract closeout submittals.

1.3 SUBSTANTIAL COMPLETION

A. “Substantial Completion” is the stage in the progress of Work when Work or designated portion thereof is sufficiently complete in accordance with Contract Documents so Owner can occupy or utilize Work for use which it is intended.
   1. Work will not be considered suitable for Substantial Completion review until all systems and equipment are operational; all designated or required governmental inspections and certifications have been made and posted, designated instruction of Owner’s personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to the Owner, and all finishes are in place. In general, the only remaining Work shall be minor in nature, such that the Owner could occupy project or designated portion thereof on following day, and completion of Work by Contractor would not materially interfere or hamper Owner’s normal business operations.

B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List expectations in the request:
1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
   a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.
2. Advise Owner of pending insurance change-over requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the work and Access to services and utilities; include occupancy permits, operating certificates, and similar releases that are required by governing or other authorities.
5. Deliver tools, spare parts, extra stock, and similar items.
6. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
7. Complete start-up testing of systems, and instruction of the Owner’s operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
8. Complete final clean up requirements, including touch-up painting. Touch-up and Otherwise repair and restore marred exposed finishes.
9. Prepare Punch List of all incomplete items for use by the Owner and Architect when reviewing for Substantial Completion.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise respective Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection and receipt/review of the Contractor-prepared Punch List, or advise respective Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. The Architect will repeat inspection when requested and assured that all the Work has been completed.
   2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
   3. Submit a certified copy of the final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been reviewed and dated by the Architect.
   4. Submit final meter reading for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
   5. Submit pest-control final inspection report and warranty.
6. Submit consent of surety to final payment.

7. Submit evidence of final, counting insurance coverage complying with insurance requirements.

B. Re-inspection Procedure: The Architect will re-inspect the work upon receipt of notice that the work, including all inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
   1. Upon completion of re-inspection the Architect and Owner will indicate final acceptance, or advise respective Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, re-inspection will be repeated.
   3. Inspection required at Substantial Completion for Texas Department of Licensing and Regulations requirements for Texas Accessibility Standards compliance.

1.5 TEXAS ACCESSIBILITY STANDARD INSPECTION

A. Provide inspection at Substantial Completion of facility in accordance with rules and regulation of the Texas Department of Licensing and Regulations (TDLR) for the purpose of determining compliance with the Texas Accessibility Standards. Inspector must be licensed with the Texas Department of Licensing and Regulations to perform the required inspection.

B. Upon receipt of Inspector’s report, immediately make corrections of any reported non-compliant items. Provide documentation to Owner of completed corrective measures.

1.6 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and anti-pollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

h. Sweep concrete floors broom clean in unoccupied spaces.

i. Power-wash concrete paving and parking areas, and concrete decks of parking garages.

j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

l. Remove labels that are not permanent.

m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.  
   1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

n. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

o. Replace parts subject to unusual operating conditions.

p. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

q. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

r. Clean ducts, blowers, and coils if units were operated without filters during construction.

s. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

t. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

1.7 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.8 RECORD DOCUMENT SUBMITTALS

A. Record Drawings: Upon completion of the work, submit electronically to the Architect for the Owner’s records.
   1. Record Contract Documents
   2. Record Shop Drawings
   3. Record Supplemental and/or newly created drawings
   4. Filed Records

C. Record Product Data: Upon completion of mark-up, submit complete set of record product data to the Architect for the Owner's records.

D. Record Sample Submitted: Comply with delivery to the Owner's sample storage area of selected Record Samples.

E. Miscellaneous Record Submittals: Submit to the Architect for the Owner's records.

F. Submit documents to Architect with claim for final Application for Payment

1.9 OPERATION AND MAINTENANCE DATA

A. Submit electronically one copy of completed manual in final form fifteen (15) calendar days prior to final inspection. This copy will be returned after final inspection, with Architect's comments. Revise content of documents as required prior to final submittal.

B. Submit electronically revised manual, within ten (10) calendar days after receipt of Architect's comments.

1.10 WARRANTIES

A. Submit electronically the Warranties with one copy of executed warranties. Provide additional copies of each warranty to include in operation and maintenance manuals.

B. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten (10) calendar days after acceptance, listing date of acceptance as start of warranty period.

C. Owner will not accept equipment or start any warranties for any part of the Work until final acceptance of the Work.

1.11 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections and as recommended by product manufacturer/supplier.

B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01700
SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   2. Divisions 02 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit electronic copies of Record Drawings as follows:
      a. Initial Submittal: Submit one electronic set of blueline prints or copies marked-up Record Prints. Architect will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return plots and prints for organizing into final electronic submittal.
      b. Final Submittal: Submit electronically two sets of revised marked-up Record Prints to Architect for preparation of final as-built documents.

B. Record Specifications: Submit electronically one copy of Project's Specifications, including addenda and contract modifications to Architect.

C. Record Product Data: Submit electronically each Product Data submittal to Architect.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an electronic insert in the electronic manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record
data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.

b. Revisions to details shown on Drawings.

c. Depths of foundations below first floor.

d. Locations and depths of underground utilities.

e. Revisions to routing of piping and conduits.

f. Revisions to electrical circuitry.

g. Actual equipment locations.

h. Duct size and routing.

i. Locations of concealed internal utilities.

j. Changes made by Change Order or Construction Change Directive.

k. Changes made following Architect's written orders.

l. Details not on the original Contract Drawings.

m. Field records for variable and concealed conditions.

n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect.

1. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.

2. Refer instances of uncertainty to Architect for resolution.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

2. Consult with Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Include identification on cover sheets.
   2. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   5. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01720
SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Preparation and submittal of Operating and Maintenance Manuals for building operating systems or equipment.

B. Preparation and submittal of instruction manuals covering the care preservation and maintenance of architectural products and finishes.

C. Instruction of the Owner's operating personnel in operation and maintenance of building systems and equipment.

D. Special operating and maintenance data requirements for specific pieces of equipment or building operating systems are included in the appropriate specification sections.

1.2 RELATED DOCUMENTS

A. Section 01300 – Submittals: Preparation of Shop Drawings and Product Data

B. Section 01700 – Contract Closeout: Project Operating and Maintenance Manuals closeout procedures.

1.3 QUALITY ASSURANCE

A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experience in operation and maintenance of the equipment or system involved.
   1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.
   2. Where drawings or diagrams are required, use draftsmen capable of preparing drawings or diagrams clearly in an understandable format.

B. Instructions for the Owner's Personnel: For instruction of the Owner’s operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

1.4 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submittal of Operating and Maintenance Manuals.
   1. Before Substantial Completion, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit electronically one (1) draft copy of each manual to the Architect for review. Include a complete index or table of contents of each manual.
a. The Architect will return electronically one copy of the draft with comments within fifteen (15) calendar days of receipt.

2. Submit one copy of data in final form at least fifteen (15) days after final inspection, with comments.

3. After final inspection make corrections or modifications to comply with the Architect’s comments. Submit electronically the specified number of copies of each approved manual to the Architect within fifteen (15) calendar days of receipt of the Architect’s comments.

B. Form of Submittal: Prepare Operating and Maintenance Manuals in the form of an electronic instructional manual for use by the Owner's operating personnel. Index data and organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single electronic file.

1. Identify each manual with the typed or printed title “OPERATION AND MAINTENANCE MANUAL,” Project title or name, and subject matter covered.

2. Text Material: Where written material is required as part of the manual, use the manufacturer's standard printed material.

3. Drawings: Where drawings or diagrams are required as part of the manual, use the manufacturer’s standard printed material.

4. Upon completion of all training, submit electronically all operating and maintenance data manuals

1.5 MANUAL CONTENT

A. In each manual include information specified in the individual specification section, and the following information for each major component of building equipment and its controls:

1. General system of equipment description
2. Design factors and assumptions
3. Copies of applicable Shop Drawings and Product Data
4. System or equipment identification, including:
   a. Name of manufacturer
   b. Model number
   c. Serial number of each component
5. Operating instructions
6. Emergency instructions
7. Wiring diagrams
8. Inspection and test procedures
9. Maintenance procedures and schedules
10. Precautions against improper use and maintenance
11. Copies of warranties
12. Repair instructions including spare parts listing
13. Sources of required maintenance and related services
14. Manual Index

B. Organize each manual into separate sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of product data, supplemented by drawings and written text, and copies of each warranted, bond and service contract issued.
1. Title Page: Provide a title as the first sheet of each manual. Provide the following information:
   a. Subject matter covered by the manual
   b. Name and address of the Project
   c. Name and address of the Owner
   d. Date of submittal
   e. Name, address, and telephone number of the Contractor
   f. Name and address of the Architect
   g. Cross-reference to related systems in other operating and maintenance manuals

2. Table of Contents: After the Title Page, include a typewritten table of contents arranged systematically according to the Project Manual or Construction Specifications Institute (CSI) Master Format. Include a list of each product included, identified by the product name or other appropriate identifying symbol and indexed to the content of the manual.

3. General Information: Provide a general information section immediately following the Table of Contents, listing each product, list the name, address, and telephone number of the subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.

4. Product Data: Where manufacturers standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.

5. Written Text: Where manufacturers standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary provide a logical sequence of instruction for each operating or maintenance procedure.

6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturers printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.
   a. Do not use original Project Record Documents as part of the Operating and Maintenance Manuals.

7. Warranties, Bonds, and Service Contracts: Provide a copy of each warranty, bond or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

1.6 MATERIAL AND FINISHES MAINTENANCE MANUAL

A. Submit electronically each manual, in final form, on material and finishes to the Architect for distribution. Provide one section for architectural products, including applied materials
and finishes, and a second for products designed for moisture-protection and products exposed to the weather.
1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

B. Architectural Products: Provide manufacturers data and instructions on care and maintenance of materials and finishes.
1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
   a. Manufacturers catalog number
   b. Size
   c. Material composition
   d. Color
   e. Texture
   f. Reordering information for specially manufactured products
2. Care and Maintenance Instructions: Provide information on care and maintenance including manufacturer’s recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturers recommended schedule for cleaning and maintenance.

C. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturers data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.
1. Manufacturers Data: Provide manufacturers data giving detailed information, including the following, as applicable:
   a. Applicable standards
   b. Chemical composition
   c. Installation details
   d. Inspection procedures
   e. Maintenance information
   f. Repair procedures

1.7 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Submit electronically each completed manual on equipment and systems, in final form, to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.
1. Refer to specification sections for additional requirements on operating and maintenance of the various pieces of equipment and operating systems.

B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
1. Description: Provide a complete description of each unit and related component parts, including the following:
   a. Equipment or system function
   b. Operating characteristics
   c. Limiting conditions
   d. Performance curves
   e. Engineering data and tests
   f. Complete nomenclature and number of replacement parts
g. Copies of Warranties

2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment provide the following:
   a. Printed operating and maintenance instructions
   b. Assembly drawings and diagrams required for maintenance
   c. List of items recommended to be stocked as spare parts
   d. Shop drawings and product data.

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
   a. Routine operations
   b. Trouble-shooting guide
   c. Disassembly, repair, and reassembly
   d. Alignment, adjusting and checking

4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
   a. Start-up procedures
   b. Equipment or system break-in
   c. Routine and normal operating instructions
   d. Regulation and control procedures
   e. Instructions on stopping
   f. Shut-down and emergency instructions
   g. Summer and winter operating instructions
   h. Required sequences for electric or electronic systems
   i. Special operating instructions
   j. Recommended “turn around” cycles.
   k. Inspection procedures.
   l. Fixture lamping schedule.

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirement, including a list of required lubricants for equipment with moving parts.
   a. Space parts list.

6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

7. Coordination Drawings: Provide each Contractor coordination drawings.
   a. Provide as-installed color-coded piping diagrams, where required for identification.

8. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.

9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panel-boards, including the following:
   a. Electric Service
   b. Controls
   c. Communication
   d. Wiring diagrams.

1.8 INSTRUCTION OF THE OWNER'S PERSONNEL

A. Prior to final inspection, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon time.
1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
2. Use operation and maintenance for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

1.9 **EMERGENCY MANUALS**

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   5. Power failure.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

**PART 2 - PRODUCTS** (Not Used)

**PART 3 - EXECUTION** (Not Used)

END OF SECTION 01730
SECTION 01740
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Administrative and procedural requirements for warranties required by the Contract Documents.
B. Manufacturers’ standard warranties on products.
C. Special warranties.

1.2 RELATED DOCUMENTS

A. Section 01700 - Contract Closeout: Requirements for contract closeout procedures.
B. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
C. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace and rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
   1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
E. Where the Contract Documents require a special warranty or similar commitment on the Work or part of the work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

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

G. The warranties specified in the individual specification sections are in addition to, and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1.4 SUBMITTALS

A. Submit written warranties electronically to the Architect prior to the date certified for Substantial Completion in PDF format. Warranties shall be organized and submitted in a logical format as per each division and section as outlined in the project specifications. If the Architect’s Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

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

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

1. Refer to Divisions 2 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Provide duplicate notarized copies.

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

E. Compile warranties and bonds in the form of an electronic document.

1. Provide a Table of Contents.
2. Table of Contents: After the Title Page, include a typewritten table of contents arranged systemically according to the Project Manual or Construction Specifications Institute (CSI) Master Format. Include a list of each product included, identified by the product name or other appropriate identifying symbol and indexed to the content of the manual.
3. Provide dividers with tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.

4. Identify the file on the first page with the typed or printed title "WARRANTIES," Project title or name, and name of Contractor.

5. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.5 ASBESTOS AND HAZARDOUS MATERIAL WARRANTY

A. Submit a warranty stating that all products, materials, systems, and installations incorporated in the Work of the Contract do not contain any asbestos or other hazardous material as defined by the Environmental Protection Agency or any other governmental agency having jurisdiction over this project.

1.6 WATER/WEATHER TIGHTNESS WARRANTY

A. Provide two (2) year warranty under provisions of Section 01700.

B. Warranty: Include coverage for water/weather tightness of building envelope

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01740
SECTION 01810

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. OPR and BoD documentation are included by reference for information only.

C. Related Sections:
   1. Division 1 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

D. Section includes General Requirements for Fundamental Commissioning (Prerequisite 1 of Energy & Atmosphere, LEED NC 3.0), and Enhanced Commissioning, (EA Credit 2 of LEED NC 3.0).

1.2 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of the Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:
1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.4 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
   1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
   2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
   3. Attend commissioning team meetings held on a monthly basis.
   4. Integrate and coordinate commissioning process activities with construction schedule.
   5. Review and accept construction checklists provided by the CxA.
   6. Complete construction checklists as Work is completed and provide to the Commissioning Authority on a monthly basis.
   7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
   8. Complete commissioning process test procedures.

1.6 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 10 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a
random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS  (Not Used)

PART 3 - EXECUTION  (Not Used)

END OF SECTION 01810
SECTION 01815

HVAC COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment for Fundamental Commissioning, (LEED NC 3.0 EA Prerequisite 1), and Enhanced Commissioning (LEED NC 3.0, EA Credit 3).

C. Related Sections:
   1. Division 1 Section "General Commissioning Requirements" for general commissioning process requirements.

1.2 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.


D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
1.4 **CxA'S RESPONSIBILITIES**

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.


1.5 **COMMISSIONING DOCUMENTATION**

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.
9. Operation and Maintenance manuals and information from the manufacturer.

1.6 **SUBMITTALS**

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

**PART 2 - PRODUCTS** (Not Used)

**PART 3 - EXECUTION**

3.1 **TESTING PREPARATION**

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
   1. The CxA will notify testing and balancing Contractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
   2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
   3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
   4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
D. The CxA along with the HVAC&R Subcontractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 15 boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 15 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 15 piping Sections. HVAC&R Subcontractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
   1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
   2. Description of equipment for flushing operations.
   4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 01815
### PROJECT CLOSEOUT CHECKLIST

The e-Builder Project Status for this Project is now "Closeout - PM".

Based upon the scope of work, Contract(s) and/or Directive(s), the Facilities Project Manager shall check the box beside all applicable closeout documents and/or closeout deliverables necessary to administratively close the Project.

Applicable Project documentation will be shared with Facility Services and Risk Management.

Future notifications will be provided once applicable closeout documentation has been received from Facilities’ consultant(s) and contractor(s).

#### Project Documentation - Section A

<table>
<thead>
<tr>
<th>Certificate of Substantial Completion</th>
<th>Yes - One (1) - Provided by one (1) Service Provider</th>
</tr>
</thead>
<tbody>
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<tr>
<td></td>
<td>Yes - More than one (1) - Provided by more than one (1) Service Provider</td>
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<tr>
<td></td>
<td>No - Certificate(s) of Substantial Completion is/are not contractually required</td>
</tr>
</tbody>
</table>

Please list all Service Providers contractually required to provide a Certificate of Substantial Completion along with the number of Certificates due per Service Provider.

<table>
<thead>
<tr>
<th>Punch List - Documentation</th>
<th>Yes - One (1) - Provided by one (1) Service Provider</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Yes - One (1) - Provided by more than one (1) Service Provider</td>
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<td></td>
<td>Yes - More than one (1) - Provided by one (1) Service Provider</td>
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<td></td>
<td>No - Punch List(s) is/are not contractually required</td>
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<tr>
<td></td>
<td>No - Punch List(s) not created. Project specifications met.</td>
</tr>
</tbody>
</table>

Please list all Service Providers who will submit a Punch List. For each Punch List, please identify how the Punch List will be documented (on/with the Certificate of Substantial Completion or a separate document).

<table>
<thead>
<tr>
<th>As-Built / Record Drawings</th>
<th>Provided by Architect, Landscape Architect, Engineer, or other Service Provider (PDF and AutoCAD) as required by contractual agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Provided by Raymond L. Goodson (RLG) in lieu of Architect</td>
</tr>
<tr>
<td></td>
<td>Not applicable - The physical dimensions of any and all space(s) with regard to the addition/removal/relocation of partitions, doors,</td>
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...
windows, millwork, etc. were not effected by the work of this Project

<table>
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<tr>
<th>Existing Space Usage Classification</th>
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<tbody>
<tr>
<td>[ ] Yes - The physical dimensions of any existing space with regard to the addition/removal/relocation of partitions, doors, windows, millwork, etc. were not effected by the work of this Project. However, the usage of one or more existing spaces changed.</td>
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<td>[ ] No</td>
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<table>
<thead>
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<th>Submittals</th>
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<td>[ ] Approved Submittals</td>
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<th>Project Manual</th>
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<tr>
<td>[ ] Project Manual (inclusive of Landscape Management/Establishment Plan)</td>
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<td>[ ] Not Applicable</td>
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<thead>
<tr>
<th>Training</th>
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<tr>
<td>[ ] Transmittal - Training Topics and Attendees</td>
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<td>[ ] Environmental</td>
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<tr>
<td>[ ] Hazardous Materials - Inspection/Abatement</td>
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<td>[ ] Testing and Balancing</td>
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<th>Landscape Management Plan</th>
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<td>[ ] 90 Day Maintenance</td>
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<td>[ ] Landscape Establishment Plan (LEP)</td>
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<td>[ ] None of the Above</td>
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<table>
<thead>
<tr>
<th>Project Documentation - Section B - SharePoint / Campus Resources / Campus Maps</th>
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<tbody>
<tr>
<td>Underground Utilities (Vaults, Manhole Covers, Tunnels, Chilled Water, Steam, Storm Sewer, Sanitary Sewer, Water, Electrical, Gas, Telephone/Fiber Optic)</td>
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<td>[ ] New (where none existed before)</td>
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<tr>
<td>[ ] Discovered (when not identified on Utility Map)</td>
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<td>[ ] Removed</td>
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<td>[ ] Abandoned in place</td>
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<td>[ ] Relocated</td>
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<td>[ ] Replaced (like-for-like / no change to path of line)</td>
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<td>Campus, School, Building, and/or Parking Center Sign</td>
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<td>Certificate of Occupancy</td>
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Project Documentation - Section C
| Documentation from the municipality with jurisdiction stating that a Certificate of Occupancy is not required | [ ] Yes [ ] No |
| Operation and Maintenance | [ ] Yes [ ] No |
| Please list all Service Providers who are to provide Operation and/or Maintenance documentation | [ ] Yes [ ] No |
| Warranty | [ ] Standard - One (1) year - Provided by one (1) Service Provider [ ] Standard - One (1) year - Provided by more than one (1) Service Provider [ ] Extended - Beyond one (1) year - Provided by one (1) Service Provider [ ] Extended - Beyond one (1) year - Provided by more than one (1) Service Provider [ ] No Warranty |
| Please list all Service Providers contractually required to provide Warranty documentation. For each Warranty, please identify how the Warranty will be documented (Certificate of Substantial Completion, separate document, or both) | [ ] Yes [ ] No |
| Basic Floor Plans and Space Usage Reporting - Provided by Raymond L. Goodson (RLG) based upon either Architect as-built or field verification of as-built condition by RLG | [ ] Transmittal - Attic Stock Delivery and Acceptance [ ] Not Applicable |
| Attic Stock | [ ] Yes [ ] No |
| Project Documentation - Section D | [ ] Yes [ ] No |
| Drawings and Records | [ ] 100% Construction Documents [ ] Contractor Record Drawings and Documents [ ] Not Applicable |
| Review and Inspection - Texas Accessibility Standards (TAS) | [ ] Yes [ ] No |
| Inspection - Municipal - Green Tag | [ ] Yes [ ] No |
| Furniture | [ ] New Purchase(s) |
| Reports, Studies, and Surveys            | [ ] Not Applicable    | [ ] Construction Materials Testing (CMT) |
|                                        |                       | [ ] Feasibility                           |
|                                        |                       | [ ] Geotechnical                          |
|                                        |                       | [ ] Stormwater Pollution Prevention Plan (SWPPP) |
|                                        |                       | [ ] Topographic                           |
|                                        |                       | [ ] None of the Above                      |

| Gift-in-Kind                           | [ ] Pavestone Pavers  |
|                                        | [ ] No Gift-in-Kind    |

| LEED                                    | [ ] Certification     |
|                                        | [ ] Commissioning     |
|                                        | [ ] No LEED           |

Please identify any other closeout documents and/or closeout deliverables related to this project not described above.

Please identify any Special Conditions and/or Comments related to the closeout and transition of this project.
SOUTHERN METHODIST UNIVERSITY
AS-BUILT AND BASIC FLOOR PLAN ELECTRONIC FILE SUBMISSION
CHECKLIST

As-Builtons delivered to Southern Methodist University must be accompanied by submission of the following checklist. When a checklist has been signed and submitted, the primary consultant is assuring that all materials adhere to the standards and guidelines set forth by the Office of Planning, Design, and Construction.

A. AS-BUILT ELECTRONIC FILE SUBMISSION CHECKLIST

As-Built Files

☐ Electronic File Format
☐ Scale and Units
☐ Tolerances
☐ Fonts
☐ Material Indications
☐ Title Blocks
☐ Sheet Size and Material
☐ Floor Identification
☐ Title Sheet/Cover Sheet
☐ Policy on Model Space and Paper Space
☐ Policy on External Reference Files

Layering

☐ Layer Index

Policy on CAD File Translation

☐ Full AutoCAD Compliance
☐ Translation Testing Procedures (if applicable)

Room Numbering

☐ Room Numbering Standard Compliance
B. BASIC FLOOR PLAN ELECTRONIC FILE SUBMISSION CHECKLIST

Basic Floor Plans

☐ CAD Files
☐ Level of Detail
☐ Layering
☐ Tolerance

Name (please print):________________________________________________________

Signature: _________________________________________________________________

Email Address: _____________________________________________________________

Phone Number: _____________________________________________________________

Date: _____________________________________________________________________
A. AS-BUILT ELECTRONIC FILE SUBMISSION

Electronic File Format
Upon completion of a project, SMU shall receive all design files associated with the project (i.e., Revit, ACAD, Navis, etc.). All CAD files shall be saved in .DWG format as AutoCAD Release 2007, at minimum.

Scale and Units
All building drawings should be drafted in architectural units, such that 1 drawing unit = 1 inch. All site drawings shall be in engineering units, such that 1 drawing unit = 1 foot.

Tolerances
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.

Fonts
If fonts are used other than those installed with Autodesk products, the font file must accompany the file when deliverables are submitted. Please try not to use personal and/or third-party fonts.

Material Indications
All files must be accompanied with a legend and description of used hatches.

Title Blocks
Each CAD file submitted shall have only one title block.

The following guidelines must be followed:

- Logos and/or images of the Project Architect and Engineer must be placed in the proper area and shall be included in file submittal.
• All drawing revisions must be properly noted in the revision list, and depict the number and date of revisions. Revisions must be noted clearly and concisely, and shall include at least 6 lines for revisions. Revisions on the drawing areas shall be clouded and tagged with a delta triangle stating the revision number. The revision number in the triangle must coincide with its revision in the revision list.

Sheet Transmission

All sheets of the As-Built documents shall be transmitted in one (1) electronic file in AutoCAD (Release 2007, at minimum).

Each sheet of the As-Built documents shall be transmitted as a separate electronic file in PDF format.

The issuance of the As-Built documents in PDF format shall include all sheets with each sheet noted as “As-Built” or “Record Drawing”.

The PDF format electronic file name of each sheet shall include the Sheet Number followed by an underscore “_” symbol and Sheet Title only.

The name of each electronic file shall NOT include the following characters:

~ " # % & * : <> ? / \ { | }

Sheet Size and Material

In accordance with the Agreement, all As-Built documents shall be transmitted in PDF format. All documents shall be created using standard ANSI paper sizes.

• Arch A: 9” x 12”
• Arch B: 12” x 18”
• Arch C: 18” x 24”
• Arch D: 24” x 36”
• Arch E: 36” x 48”
• Arch E1: 30” x 42”

Floor Identification

The standard floor identification code follows a two digit numbering system. Floor numbering should start with the lowest floor – either above grade, at grade, or below grade –
numbered sequentially in ascending order, starting with 01 and continuing with 02, 03, etc. No new construction on SMU’s campus will have levels named basement or sub-level.

Title Sheet / Cover Sheet

A title sheet shall be included on all projects. Indicate sheet numbers and description. The title sheet shall have the following minimum information:

1. Project name and location.
2. Name, address, phone number, fax number, email address of the A/E, and any consultants used on the project.
3. The following SF must be represented for the building and individual floors:
   a. Gross Square Footage (GSF)
      i. The area of each floor of a building measured to the outside faces of the exterior walls with a clearance height of eight feet, disregarding cornices, pilasters, buttresses, etc.
   b. Net Square Feet (NSF)
      i. NSF is the total usable square footage of a facility; that is, the square footage that is measured from the inside wall surfaces. Included in this figure are non-assignable spaces such as mechanical rooms, toilets, corridors, etc.
   c. Net Assignable Square Footage (NASF)
      i. NASF is the total assignable square footage of a facility, measured from the inside wall surfaces, not including non-assignable spaces such as mechanical rooms, toilets, corridors, etc.
   d. Non-Assignable Square Footage (NonASF)
      i. NonASF is the sum of all areas on all floors of a building not available for assignment to an occupant or for specific use, but necessary for the general operation of a building.
4. Index of all drawings included in the Contract Documents.
5. File Number/Sequence number.
6. Location map indicating the location of the project on the particular campus or the town.
7. List of symbols and abbreviations used in the Contract Documents. Abbreviations used on the drawings must be industry standard recognized abbreviations and must be consistent throughout the construction documents.
8. Current Uniform Construction Code criteria valid for the applicable project location.

Policy on Model Space and Paper Space

- **Model Space Only.** Both the drawing model and the drawing’s title block are contained in the same model space environment within a single CAD file. The paper space environment is not used. *This method is not allowed and will not be accepted.*
• **Model Space and Paper Space Combined.** Each CAD file is set up to contain only one title block in paper space which references the building model(s) contained in model space. In occasions where more than one border per CAD file is needed, tabs may be created to accommodate multiple sheets.

**Policy on External Reference Files**

SMU will not accept the submission of any CAD drawing deliverables which contain references to external source drawing files. All externally referenced data sources used during the CAD drawing production phase shall be inserted and retained as a block on layer XREF, including the title block, upon project completion and prior to drawing delivery to the Office of Planning, Design, and Construction.

**LAYERING**

**Layer Index**

The contracted A/E firm shall provide a layer index stating used layers and description for all As-Bults.

**POLICY ON CAD FILE TRANSLATION**

**Error-free AutoCAD Drawing Deliverables**

All DWG files and CAD drawings submitted at the end of a project must be able to be manipulated using standard AutoCAD drafting procedures. Non-compliance with this policy may result in the rejection of CAD files submitted at project closeout in addition to delayed rendering of final project payment. DXF files will not be accepted at project closeout as a substitution for DWG CAD file deliverables.

Translation Testing Recommended
For firms translating their native CAD file format into AutoCAD format, and concerned about delivering error-free CAD files to SMU upon project closeout, it is strongly recommended that thorough file translation testing be conducted before the drawing development phase of the project. This will assure early detection of file conversion issues, if any, and allow for corrective measures to be taken before the project closeout period.

**ROOM NUMBERING**

The A/E shall use the SMU room numbering standards on all drawings. Room numbers should be assigned at the 50% construction document phase. The A/E will work with Project Administrative Coordinator in the Office of Planning, Design, and Construction to develop room numbers consistent with the University’s system.

Consistent room numbering will facilitate matters for numerous organizations, including Inventory Control, Fire and Emergency Services, and Facilities Maintenance Services. First, the basic knowledge of the definitions below must be understood:

- **Corridor**: A space normally used for pedestrian traffic, at least 5 feet wide and enclosed by solid walls.
- **First Floor**: The lowest floor of any building which is at least 50% above grade.
- **Lobby**: A space used for traffic that is a point for ingress or egress to a building or floor from upper or lower floors.
- **Room**: A clearly defined space not normally used for through traffic and enclosed by solid walls.
- **Suite**: A connected series of rooms to be used together stemming from a main room.
- **Vestibule**: A space used for traffic that is a point of ingress or egress to a building, with doors on two walls.

Room numbers should flow in an ascending order beginning in the southwest corner of the building. In a building with a more complex corridor system, numbers should flow in ascending order in a clockwise direction from the true southwest corner of the building. Even numbers should apply to rooms on the right side of the corridor and odd numbers to rooms on the left, moving away from the southwest corner. Numbers should be in direct sequence, and only one number should be applied to one room regardless of the number of doors to that room off the corridor.

To the greatest extent possible, without creating other inconsistencies, rooms with the same digits in the last two positions should be located in the same position in the building. Thus, S001, 101, 201, 301, etc., occur in a vertical stack.
Skip numbers as appropriate in order to reserve numbers for future use. Most buildings undergo renovation many times; and when, as is often the case, larger spaces are divided into smaller areas, new room numbers will be needed. Having numbers in reserve will avoid the need to re-number an entire level.

Rooms within a suite which have no direct entrance from a corridor should be designated by adding a letter after the number of the room through which they are entered from the Corridor (ex. 101A). If they can be entered through more than one room, the number of the room most frequently used to gain access should be used. Alpha suffixes within a suite should be assigned beginning with the first room to the left of the main entrance and proceed in a clockwise direction.

Floor areas designed for elevators, stairwells, internal and covered external circulation, restrooms, electrical, mechanical, custodial, and telephone equipment rooms also need designations. Please refer to the room type chart below.
**ROOM TYPE CHART**

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>Text</th>
<th>Numbering Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrooms</td>
<td>Bath Men or Bath Women or Bath Unisex</td>
<td>Number in sequence with all rooms with suffix RR</td>
</tr>
<tr>
<td>Custodial Room</td>
<td>JA</td>
<td>Number in sequence with all rooms with suffix JA</td>
</tr>
<tr>
<td>Electrical Room</td>
<td>EL</td>
<td>Number in sequence with all rooms with suffix EL</td>
</tr>
<tr>
<td>Mechanical Room</td>
<td>ME</td>
<td>Number in sequence with all rooms with suffix ME</td>
</tr>
<tr>
<td>Telephone Equipment</td>
<td>TELE</td>
<td>Number in sequence with all rooms with suffix TELE</td>
</tr>
<tr>
<td>Elevators*</td>
<td>EL</td>
<td>Number in sequence with all rooms with alpha affix “EL” and number each sequentially, ex: EL101, EL102, EL201, and EL202</td>
</tr>
<tr>
<td>Corridors*</td>
<td>CR</td>
<td>Number in sequence with all rooms with alpha affix “CR”, ex: CR101, CR102, CR201, and CR202</td>
</tr>
<tr>
<td>Stairs*</td>
<td>ST</td>
<td>Number in sequence with all rooms with alpha affix “ST”, ex: ST101, ST102, ST201, and ST202</td>
</tr>
<tr>
<td>Chases*</td>
<td>CH</td>
<td>Number in sequence with all rooms with alpha affix “CH”, ex: CH101, CH102, CH201, and CH202</td>
</tr>
<tr>
<td>External Circulation*</td>
<td>EC</td>
<td>Number in sequence with all rooms with alpha affix “EC”, ex: EC101, EC102, EC201, and EC202</td>
</tr>
<tr>
<td>Other (SMU Approved)</td>
<td>t.b.d.</td>
<td>t.b.d.</td>
</tr>
</tbody>
</table>

Doors should be numbered with a system which reflects the room number to which the door allows access. For example, the door to room 104 should be labeled "104/1" or "104/A" or similar system.

The basic premise of the University’s room numbering standards assumes a fairly simple floor plan, a situation which seldom occurs in actual practice. Most new buildings have complicated floor plans designed to suit a specific purpose and numerous alterations and...
additions to older buildings often wreak havoc on established room-numbering systems. However, it is possible to establish a fairly reasonable room numbering plan for virtually any building, provided that the basic rules are applied and tempered with common sense and judgment.
B. BASIC FLOOR PLAN ELECTRONIC FILE SUBMISSION

CAD Files

In addition to the As-Builts, the A/E shall provide Basic Floor Plans in ACAD release 2007 at a minimum. These files shall reflect final project As-Built conditions. Each building level shall be a separate CAD file drawing so one drawing unit = 1”. Each floor shall be an individual file drawn in model space.

Level of Design

See Attachment A for example. All CAD files shall contain the following:

- Walls (interior & exterior)
- Doors (interior & exterior)
- Windows (interiors & exteriors)
- Stairs
- Elevators
- Built-in millwork
- Plumbing fixtures
- Room # and Room Use
- NSF of each space

Layering

See Attachment “A” for a list of allowed layers for each required item. All unused layers shall be purged from file.

Tolerance

The NSF for each useable space must be to the nearest square foot.
# Sustainable Sites

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Y</td>
<td>Construction Activity Pollution Prevention</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Site Selection</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Development Density and Community Connectivity</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Brownfield Redevelopment</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Alternative Transportation—Public Transportation Access</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Alternative Transportation—Bicycle Storage and Changing Rooms</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Alternative Transportation—Parking Capacity</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Site Development—Protect or Restore Habitat</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Site Development—Maximize Open Space</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Stormwater Design—Quantity Control</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Stormwater Design—Quality Control</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Heat Island Effect—Non-roof</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Heat Island Effect—Roof</td>
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<tr>
<td></td>
<td>Light Pollution Reduction</td>
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</tr>
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</table>

# Water Efficiency

<table>
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<th>Credit</th>
<th>Description</th>
<th>Possible Points</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Y</td>
<td>Water Use Reduction—20% Reduction</td>
<td>2 to 4</td>
</tr>
<tr>
<td></td>
<td>Water Efficient Landscaping</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reduce by 30%</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>No Potable Water Use or Irrigation</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Innovative Wastewater Technologies</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Water Use Reduction</td>
<td>2 to 4</td>
</tr>
<tr>
<td></td>
<td>Reduce by 30%</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reduce by 35%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Reduce by 40%</td>
<td>4</td>
</tr>
<tr>
<td>Energy and Atmosphere</td>
<td>Possible Points: 35</td>
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</tr>
<tr>
<td>----------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Y</strong></td>
<td><strong>Y</strong></td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>Prereq 1</td>
<td>Fundamental Commissioning of Building Energy Systems</td>
<td></td>
</tr>
<tr>
<td>Prereq 2</td>
<td>Minimum Energy Performance</td>
<td></td>
</tr>
<tr>
<td>Prereq 3</td>
<td>Fundamental Refrigerant Management</td>
<td></td>
</tr>
<tr>
<td>Credit 1</td>
<td>Optimize Energy Performance</td>
<td></td>
</tr>
<tr>
<td>Improve by 12% for New Buildings or 8% for Existing Building Renovations</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Improve by 14% for New Buildings or 10% for Existing Building Renovations</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Improve by 16% for New Buildings or 12% for Existing Building Renovations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Improve by 18% for New Buildings or 14% for Existing Building Renovations</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Improve by 20% for New Buildings or 16% for Existing Building Renovations</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Improve by 22% for New Buildings or 18% for Existing Building Renovations</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Improve by 24% for New Buildings or 20% for Existing Building Renovations</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Improve by 26% for New Buildings or 22% for Existing Building Renovations</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Improve by 28% for New Buildings or 24% for Existing Building Renovations</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Improve by 30% for New Buildings or 26% for Existing Building Renovations</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Improve by 32% for New Buildings or 28% for Existing Building Renovations</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Improve by 34% for New Buildings or 30% for Existing Building Renovations</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Improve by 36% for New Buildings or 32% for Existing Building Renovations</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Improve by 38% for New Buildings or 34% for Existing Building Renovations</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Improve by 40% for New Buildings or 36% for Existing Building Renovations</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Improve by 42% for New Buildings or 38% for Existing Building Renovations</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Improve by 44% for New Buildings or 40% for Existing Building Renovations</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Improve by 46% for New Buildings or 42% for Existing Building Renovations</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Improve by 48%+ for New Buildings or 44%+ for Existing Building Renovations</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Credit 2</td>
<td>On-Site Renewable Energy</td>
<td></td>
</tr>
<tr>
<td>1% Renewable Energy</td>
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<td></td>
</tr>
<tr>
<td>3% Renewable Energy</td>
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<td></td>
</tr>
<tr>
<td>5% Renewable Energy</td>
<td>3</td>
<td></td>
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<tr>
<td>7% Renewable Energy</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>9% Renewable Energy</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>11% Renewable Energy</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>13% Renewable Energy</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Credit 3</td>
<td>Enhanced Commissioning</td>
<td></td>
</tr>
<tr>
<td>Credit 4</td>
<td>Enhanced Refrigerant Management</td>
<td></td>
</tr>
<tr>
<td>Credit 5</td>
<td>Measurement and Verification</td>
<td></td>
</tr>
<tr>
<td>Credit 6</td>
<td>Green Power</td>
<td></td>
</tr>
<tr>
<td>Last Revision: June 2019</td>
<td>Sustainable Design / Green Building Approach</td>
<td></td>
</tr>
</tbody>
</table>
### Materials and Resources

<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 1.1 Building Reuse—Maintain Existing Walls, Floors, and Roof</th>
<th>Possible Points: 14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reuse 55%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reuse 75%</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reuse 95%</td>
<td>3</td>
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</table>

<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 1.2 Building Reuse—Maintain 50% of Interior Non-Structural Elements</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Credit 2 Construction Waste Management</td>
<td>1 to 2</td>
</tr>
<tr>
<td></td>
<td>50% Recycled or Salvaged</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>75% Recycled or Salvaged</td>
<td>2</td>
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<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 3 Materials Reuse</th>
<th>1 to 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reuse 5%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reuse 10%</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 4 Recycled Content</th>
<th>1 to 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10% of Content</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>20% of Content</td>
<td>2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 5 Regional Materials</th>
<th>1 to 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10% of Materials</td>
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</tr>
<tr>
<td></td>
<td>20% of Materials</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 6 Rapidly Renewable Materials</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Credit 7 Certified Wood</td>
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### Indoor Environmental Quality

<table>
<thead>
<tr>
<th>Prereq</th>
<th>Credit 1 Outdoor Air Delivery Monitoring</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Credit 2 Increased Ventilation</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 3.1 Construction IAQ Management Plan—During Construction</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 3.2 Construction IAQ Management Plan—Before Occupancy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 4.1 Low-Emitting Materials—Adhesives and Sealants</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 4.2 Low-Emitting Materials—Paints and Coatings</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 4.3 Low-Emitting Materials—Flooring Systems</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 4.4 Low-Emitting Materials—Composite Wood and Agrifiber Products</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 5 Indoor Chemical and Pollutant Source Control</td>
<td>1</td>
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<tr>
<td></td>
<td>Credit 6.1 Controllability of Systems—Lighting</td>
<td>1</td>
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<tr>
<td></td>
<td>Credit 6.2 Controllability of Systems—Thermal Comfort</td>
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<tr>
<td></td>
<td>Credit 7.1 Thermal Comfort—Design</td>
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</tr>
<tr>
<td></td>
<td>Credit 7.2 Thermal Comfort—Verification</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Credit 8.1 Daylight and Views—Daylight</td>
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<tr>
<td></td>
<td>Credit 8.2 Daylight and Views—Views</td>
<td>1</td>
</tr>
</tbody>
</table>
### Innovation and Design Process

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Innovation in Design: Specific Title</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Innovation in Design: Specific Title</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>Innovation in Design: Specific Title</td>
<td>1</td>
</tr>
<tr>
<td>1.4</td>
<td>Innovation in Design: Specific Title</td>
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<td>Innovation in Design: Specific Title</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>LEED Accredited Professional</td>
<td>1</td>
</tr>
</tbody>
</table>

**Possible Points:** 6

### Regional Priority Credits

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Regional Priority: Specific Credit</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Regional Priority: Specific Credit</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
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<td>1</td>
</tr>
<tr>
<td>1.4</td>
<td>Regional Priority: Specific Credit</td>
<td>1</td>
</tr>
</tbody>
</table>

**Possible Points:** 4

**Total Possible Points:** 110

Certified 40 to 49 points  Silver 50 to 59 points  Gold 60 to 79 points  Platinum 80 to 110
DGS Basis of Design (BOD) for Small Buildings
DRAFT TEMPLATE – August 19, 2006

[Note to Project Director: Documentation of the Basis of Design (BOD) is a step required for compliance with LEED-NC 2.2 EA Prerequisite 1 for Fundamental Commissioning of the Building Energy Systems. This template is a guide for use by the design team.]

1. HVAC System

1.1 Narrative Description of System
   A. [System type(s), location, control type, efficiency features, outdoor air ventilation strategy, indoor air quality features, noise reduction features, environmental benefits, other special features]
   B. [Describe how system meets any special requirements listed in the Owner’s Project Requirements document.]

1.2 Reasons for System Selection
   A. [Reasons that the selected system is a better choice than alternatives. E.g. comfort performance, efficiency, reliability, flexibility, simplicity, cost, owner preferences, site constraints, climate, availability of maintenance, acoustics]

1.3 Load Calculations
   A. Load calculation method/software: ______________________
   B. Summer outdoor design conditions: __°F drybulb, __°F wetbulb
   C. Winter outdoor design conditions: __°F drybulb
   D. Indoor design conditions: __°F, __%RH cooling; __°F heating
   E. Internal heat gain assumptions:

<table>
<thead>
<tr>
<th>Space</th>
<th>Lighting Load</th>
<th>Plug Load</th>
<th>Occupant Load</th>
<th>Infiltration Load</th>
<th>Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

   F. Calculated cooling loads and system size:

<table>
<thead>
<tr>
<th>System/ Air Handler ID</th>
<th>Calculated Peak Cooling Load</th>
<th>Selected System Cooling Capacity</th>
<th>Reasons for difference between calculated load and selected system capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 This document template applies to buildings smaller than 10,000 ft² that are served by simple HVAC systems such as single-zone packaged rooftop units.

2 This draft prepared by Architectural Energy Corporation, under contract with the California Energy Commission’s Public Interest Energy Research program.
G. Other load calculation assumptions:

1.4 Sequence of Operations
   A. [Operating schedules, setpoints, etc. May refer to plans and/or specifications if sequence of operations is included there.]

2. Indoor Lighting System

2.1 Narrative Description of System
   A. Fixture type(s)
   B. Lamp and ballast type
   C. Control type
   C. [Describe how system meets any special requirements listed in the Owner’s Project Requirements document.]

2.2 Reasons for System Selection
   A. [Reasons that the selected lighting system is a better choice than alternatives. E.g. visual comfort performance, efficiency, reliability, flexibility, simplicity, cost, owner preferences, color rendering, integration with daylighting, ease of maintenance, etc.]

2.3 Lighting Design Criteria

<table>
<thead>
<tr>
<th>Space ID</th>
<th>Space Type</th>
<th>Illumination Design Target (footcandles)</th>
<th>Source of Target (e.g. IES Standard, Owner Requirement)</th>
<th>Other Lighting Design Criteria: [e.g. CRI, CCT]</th>
</tr>
</thead>
</table>

2.4 Lighting Power Design Targets

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Title 24 Lighting Power Allowance (watts/ft²)</th>
<th>Lighting Power Design Target (watts/ft²)</th>
</tr>
</thead>
</table>

3. Water Heating System

3.1 Narrative Description of System
   A. [System type(s), location, control type, efficiency features, environmental benefits, other special features]
B. [Describe how system meets any special requirements listed in the Owner’s Project Requirements document.]

3.2 Reasons for System Selection

A. [Reasons that the selected water heating system is a better choice than alternatives. E.g. efficiency, reliability, simplicity, space constraints, cost, owner preferences, ease of maintenance, etc.]

3.3 Water Heating Load Calculations

A. [Describe sizing calculation method, assumptions, and results]
SPECIAL CONDITIONS, INCLUSIONS AND EXCLUSIONS

1. Specific Inclusions: (Included but not limited to)

   A. Complete [define scope] except as modified otherwise herein.

   B. This project is governed by the Leadership in Energy and Environmental Design (LEED) green building rating program. You can familiarize yourself with this program at the United States Green Building Council (USGBC) website (www.usgbc.org). Subcontractor will participate fully as required to achieve LEED certification, per the point strategy outlined in the Exhibit N LEED-NC Version 3.0 Registered Project Checklist.

   C. For LEED certifications and other LEED documentation that must be approved prior to putting work in place, Subcontractor will submit LEED items concurrent with the related submittals required by contract documents. Submittals will be made early enough to allow adequate time for review and approval prior to ordering materials and installing work.

   D. LEED certifications that document installed work will be submitted with each Subcontractor application for payment. Subcontractor payment may be withheld per Subcontract Article 4 Progress Payments if required LEED information has not been submitted.

   E. Where required as related to the subcontract scope of work, the following LEED templates will be submitted. Subcontractor should submit a draft template as the subcontract work begins and again at least 30 days prior to subcontractor’s final pay application.

      • Materials & Resources (MR) Credit 3.1-3.2 Resource Reuse
      • MR Credit 4.1-4.2 Recycled Content
      • MR Credit 5.1-5.2 Local Regional Materials
      • MR Credit 6 Rapidly Renewable Materials
      • MR Credit 7 Certified Wood
      • Indoor Environmental Quality (EQ) Credit 3.1 Construction Indoor Air Quality Plan
        (to include filtration media information and photographs with labeling indicating SMACNA approach information)
      • EQ Credit 4.1-4.4 Low Emitting Materials
(submit lists required by Low Emitting Materials letter template for adhesives, interior paints, coatings, carpet systems, composite wood and agrifiber)

The Owner will review these documents for completion and correctness before releasing final payment. Reference Exhibit N for LEED templates.

F. We will divert as much construction waste from the landfill as possible, which will require everyone’s diligence and effort. Subcontractor will deposit trash in properly designated waste receptacles provided by the contractor located at the recycle center on site as required by Exhibit N Construction Waste Management Plan (see LEED Materials & Resources Credits 2.1 and 2.2 for more information). Subcontractor will maintain waste containers in work areas as needed to accomplish segregation of Subcontractor’s material. Costs incurred by the contractor to deposit the Subcontractor’s trash in waste receptacles, or to remove trash deposited in the wrong receptacles by this Subcontractor, will be invoiced to this Subcontractor. If dumpsters designated for recycling materials must be taken to the landfill because of contamination caused by this Subcontractor, associated tipping fees will be invoiced to this Subcontractor.

G. To provide the best possible air quality for future building occupants, we will keep conditioned air pathways and other parts of the building clean, dry and dust free during construction. Subcontractor will limit dust accumulation in the building, remove dust that is created by the subcontractor’s work, follow moisture control procedures and otherwise comply with the requirements of Exhibit N Construction Indoor Air Quality Plan.

H. Subcontractor will submit materials that comply with volatile organic compound (VOC) materials requirements of the contract documents, and will off-gas products containing VOC’s per Exhibit N Construction Indoor Air Quality Plan.

I. Wood that is physically incorporated into this project, and wood used temporarily to build this project (such as formwork and temporary construction barriers) will be certified by the Forestry Stewardship Council (FSC) and will be sourced from the FSC. Formwork does not have to be FSC certified if written documentation is provided demonstrating that the formwork is rented or delivered for use on another project after use on this project. (reference LEED MR Credit 7 Certified Wood). Qualified Vendors List (latest list is available at www.fscus.org). Subcontractor must have submitted a proper, complete FSC Bid Assurance Form prior to ordering materials and beginning work. Subcontractor will submit FSC Chain of Custody (COC) certificates prior to purchasing wood materials. Subcontractor will submit FSC certified product invoices from qualified suppliers monthly and will maintain and submit monthly the FSC Product Accounting Form. Product invoices are required to have the FSC certified company COC number referring to the certified products on a line item basis. Subcontractor will submit FSC Project Documentation Summary Form for wood products used as part of this Contract.

J. Where required as related to the subcontract scope of work, Subcontractor will participate in the following activities relating to Energy & Atmosphere (EA) Credit 3 Additional Commissioning: focused review of contract documents, reviews of submittals and additional commissioning activities required by third party.
Commissioning Authority, development of Re-commissioning Management Manual, near-warranty end and post occupancy re-commissioning activities.

K. Where required as related to the subcontract scope of work, Subcontractor will participate in the following activities relating to Energy & Atmosphere (EA) Credit 5 Measurement & Verification: assist Owner’s personnel in measurement and verification activities and address any deficiencies that are identified as a result of their activities through the specified warranty period, submit with operations and maintenance (O&M) manuals an ongoing measurement and verification system maintenance and operating plan. Typical systems requiring measurement are lighting and controls, motors, variable frequency drives, chillers and other cooling equipment, economizers, heat recovery systems, air distribution systems, boilers, building energy efficiency systems, water distribution and management systems, and irrigation.

L. Where required as related to the subcontract scope of work, provide training to Owner personnel for LEED related systems, such as recycled material storage and collection systems, waterless urinals, and lighting and thermal comfort control systems.

4. Specific Exclusions:

A. Define.
Owner’s Project Requirements Document for LEED Fundamental Commissioning

Project: ____________________________________________________

Approved:

Name ___________________________ Owner’s Representative ___________________________ Date ___________

Name ___________________________ Design Agent’s Representative ___________________________ Date ___________

Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Owner’s goals, expectations and requirements for commissioned systems, and shall be utilized throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating systems’ energy and environmental performance.

The Owner’s Project Requirements Document is a required document for LEED Version 3.0EA Prerequisite 1, Fundamental Commissioning of the Building Energy Systems. It shall be completed by the Corps District/Design Agent based on coordination with the Installation/User/Proponent and shall be approved by the Installation/User/Proponent representative.

Use of this template is not required, nor are there any restrictions on editing of it. It is provided simply as a tool to assist project teams in meeting the documentation requirements for LEED Fundamental Commissioning.

The intent of the Owner’s Project Requirements Document, per the LEED v 3.0 Reference Guide, is to detail the functional requirements of a project and the expectations of the building’s use and operation as it relates to commissioned systems. This template contains the basic recommended components indicated in the LEED v 3.0 Reference Guide. It should be adapted as needed to suit the project, remaining reflective of the LEED intent.

The Owner’s Project Requirements Document should ideally be completed before the start of design and furnished to the design team. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements.
Updates to the Owner’s Project Requirements Document throughout the course of project delivery shall be made by the Corps District/Design Agent based on decisions and agreements coordinated with and agreed to by the Installation/User/Proponent.

The Owner’s Project Requirements Document shall be included in the project’s LEED documentation file under EA PR1, Fundamental Commissioning of the Building Energy Systems.

**Owner’s Project Requirements Document for LEED Fundamental Commissioning**

**Table of Contents**

1. Owner and User Requirements
   - Primary Purpose, Program and Use
   - Project History
   - Broad Goals

2. Environmental and Sustainability Goals
   - Energy Efficiency Goals
   - General
   - Siting
   - Building Façade
   - Building Fenestration
   - Building Envelope
   - Roof
   - Other

3. Indoor Environmental Quality Requirements
   - Intended Use
   - Occupancy Schedule
   - Accommodations for After-Hours Use
   - Lighting, Temperature, Humidity, Air Quality, Ventilation, Filtration
   - Acoustics
   - Occupant Ability to Adjust System Controls
   - Types of Lighting

4. Equipment and Systems Expectations
   - Space Heating
   - Ventilation
   - Air Conditioning
   - Refrigeration
   - HVAC Controls
   - Domestic Hot Water
   - Lighting Controls (including occupancy sensors)
   - Daylighting Controls
   - Emergency Power
   - Other

5. Building Occupant and O&M Personnel Requirements
   - Facility Operation
   - EMCS
   - Occupant Training and Orientation
• O&M Staff Training and Orientation

TABLE 1

1.1 1. **Owner and User Requirements**

What is the primary purpose, program and use of this project? (example: office building with data center)

____________________________________________________________________________

____________________________________________________________________________

Describe pertinent project history. (example: standard design development)

____________________________________________________________________________

____________________________________________________________________________

1.1.1 **Broad Goals**

What are the broad goals relative to program needs?

____________________________________________________________________________

____________________________________________________________________________

What are the broad goals relative to future expansion?

____________________________________________________________________________

____________________________________________________________________________

What are the broad goals relative to flexibility?

____________________________________________________________________________

____________________________________________________________________________

What are the broad goals relative to quality of materials?

____________________________________________________________________________

____________________________________________________________________________

What are the broad goals relative to construction costs?

____________________________________________________________________________

____________________________________________________________________________

What are the broad goals relative to operational costs?

____________________________________________________________________________

____________________________________________________________________________
1.1.2  2. Environmental and Sustainability Goals

What are the project goals relative to sustainability and environmental issues? (example: LEED Silver rating)

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What are the project goals relative to energy efficiency? (example: Meet EPACT)

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What are the project goals and requirements for building siting that will impact energy use?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What are the project goals and requirements for building facade that will impact energy use?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What are the project goals and requirements for building fenestration that will impact energy use?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What are the project goals and requirements for building envelope that will impact energy use?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What are the project goals and requirements for building roof that will impact energy use?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Other: (Insert as applicable)
1.1.3  3. Indoor Environmental Quality Requirements

What is the intended use for all spaces? For all spaces that have an intended use that is not readily apparent from the space name, provide this information in Table 1.

What is the anticipated occupancy schedule (numbers of occupants and time frames) for all occupied spaces? Indicate the default occupancy schedule below and for all spaces that have an occupancy schedule that differs from the default, provide this information in Table 1.

What accommodations for after-hours use are required? (example: access control, lighting controls, HVAC controls) Indicate general accommodations required below and for all spaces that have special requirements, provide this information in Table 1.

What are the lighting, temperature, humidity, air quality, ventilation and filtration requirements for all spaces? Indicate the default requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

Lighting: ____________________________
Temperature: ____________________________
Humidity: ____________________________
Air Quality: ____________________________
Ventilation: ____________________________
Filtration: ____________________________

What are the acoustical requirements for all spaces? Indicate the default acoustical requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

What is the desired level of occupant ability to adjust systems controls? Indicate the default desired levels below and for all spaces that have a desired level that differs from the default, provide this information in Table 1.
Lighting:________________________________________________________________________
Temperature:___________________________________________________________________
Humidity: _____________________________________________________________________
Air Quality: ___________________________________________________________________
Ventilation: ___________________________________________________________________

What, if any, specific types of lighting are desired? (example: fluorescent in 2x2 grid, accent lighting, particular lamps)
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

1.1.4 4. Equipment and System Expectations

(Complete for each category as applicable or indicate “none identified” or “N/A”. Add desired features information for other anticipated commissioned systems as applicable)

Indicate desired features for the following commissioned system: Space Heating
Desired Type: _________________________________________________________________
Quality: ______________________________________________________________________
Preferred Manufacturer: _________________________________________________________
Reliability: __________________________________________________________________
Automation: __________________________________________________________________
Flexibility: __________________________________________________________________
Maintenance Requirements: _____________________________________________________
Efficiency Target: ______________________________________________________________
Desired Technologies: __________________________________________________________

Indicate desired features for the following commissioned system: Ventilation
Desired Type: _________________________________________________________________
Quality: ______________________________________________________________________
Preferred Manufacturer: _________________________________________________________
Reliability: __________________________________________________________________
Automation: __________________________________________________________________
Flexibility: __________________________________________________________________
Maintenance Requirements: _____________________________________________________
Efficiency Target: ______________________________________________________________
Desired Technologies: __________________________________________________________

Indicate desired features for the following commissioned system: Air Conditioning
Desired Type: _________________________________________________________________
Indicate desired features for the following commissioned system: Refrigeration
Desired Type: ________________________________________________________________

Quality: _____________________________________________________________________
Preferred Manufacturer: ________________________________________________________
Reliability: __________________________________________________________________
Automation: __________________________________________________________________
Flexibility: ___________________________________________________________________
Maintenance Requirements: _____________________________________________________
Efficiency Target: _____________________________________________________________
Desired Technologies: __________________________________________________________

Indicate desired features for the following commissioned system: HVAC Controls
Desired Type: ________________________________________________________________

Quality: _____________________________________________________________________
Preferred Manufacturer: ________________________________________________________
Reliability: __________________________________________________________________
Automation: __________________________________________________________________
Flexibility: ___________________________________________________________________
Maintenance Requirements: _____________________________________________________
Efficiency Target: _____________________________________________________________
Desired Technologies: __________________________________________________________

Indicate desired features for the following commissioned system: Domestic Hot Water
Desired Type: ________________________________________________________________

Quality: _____________________________________________________________________
Preferred Manufacturer: ________________________________________________________
Reliability: __________________________________________________________________
Automation: __________________________________________________________________
Flexibility: ___________________________________________________________________
Maintenance Requirements: _____________________________________________________
Efficiency Target: _____________________________________________________________
Desired Technologies: __________________________________________________________

Indicate desired features for the following commissioned system: Lighting Controls
Desired Type: _________________________________________________________________
Quality: ______________________________________________________________________
Preferred Manufacturer: __________________________________________________________________________________
Reliability: ______________________________________________________________________
Automation: ______________________________________________________________________
Flexibility: ______________________________________________________________________
Maintenance Requirements: __________________________________________________________________________________
Efficiency Target: __________________________________________________________________________________
Desired Technologies: __________________________________________________________________________________

Indicate desired features for the following commissioned system: Daylighting Controls
Desired Type: _________________________________________________________________
Quality: ______________________________________________________________________
Preferred Manufacturer: __________________________________________________________________________________
Reliability: ______________________________________________________________________
Automation: ______________________________________________________________________
Flexibility: ______________________________________________________________________
Maintenance Requirements: __________________________________________________________________________________
Efficiency Target: __________________________________________________________________________________
Desired Technologies: __________________________________________________________________________________

Indicate desired features for the following commissioned system: Emergency Power
Desired Type: _________________________________________________________________
Quality: ______________________________________________________________________
Preferred Manufacturer: __________________________________________________________________________________
Reliability: ______________________________________________________________________
Automation: ______________________________________________________________________
Flexibility: ______________________________________________________________________
Maintenance Requirements: __________________________________________________________________________________
Efficiency Target: __________________________________________________________________________________
Desired Technologies: __________________________________________________________________________________

Indicate desired features for the following commissioned system: Other - ________________
Desired Type: ______________________________________________________________________
1.1.5  

5. **Building Occupant and O&M Personnel Requirements**

How will the facility be operated? Who will operate the facility?

____________________________________________________________________________

____________________________________________________________________________

Will the facility be connected to an EMCS? If so, what are the interface requirements? (example: monitoring points, control points, scheduling)

____________________________________________________________________________

____________________________________________________________________________

What is the desired level of training and orientation for building occupants to understand and use the building systems?

____________________________________________________________________________

____________________________________________________________________________

What is the desired level of training and orientation for O&M staff to understand and maintain the building systems?

____________________________________________________________________________

____________________________________________________________________________
|-------|----------------|-------------|-----------------------------|------------------------|-----------------------|-----------------------|------------------------|-------------------------------|----------------------|----------------------|-------------------------------|-------------------|

*Table 1*
Waste Management Plan

Construction Waste Management MR Credit 2.1 and 2.2
Waste Management Plan (Version 1.0)
Waste Management Plan (WMP)

Overview

This plan is developed to satisfy Leadership in Energy and Environmental Design (LEED) Materials & Resources (MR) Credits 2.1 and 2.2. We will divert as much project waste from landfills as possible, but at a minimum 75 percent by weight as required by MR Credit 2.2.

Diverting waste from landfills:

- Extends the life of existing landfills and defers creation of new landfills
- Returns resources to the production cycle that are difficult to recover once in a landfill
- Salvages some of the embodied energy originally used to bring the material to market
- Looked at another way: reduces the resources and energy needed to make materials (recycled aluminum takes five percent of the energy needed to make aluminum from virgin resources)
- May improve project cost
- May enhance profit margin

Materials that will be reused, salvaged or recycled on this project: vegetation, dirt, stone, asphalt, wood, pallets, concrete, masonry materials, metals, glass, sheetrock, insulation, carpet, plastic, paper and cardboard.

The Contractor will manage the waste management plan and will train subcontractor personnel during jobsite orientation and as otherwise required. The waste management contractor (WMC) will provide monthly summaries of recycling performance by weight, with breakdowns by recycling category. Reports will be posted monthly so that all construction personnel have an opportunity to see the results. The WMC will review progress and identify and resolve issues monthly. Any waste management issues that warrant project-wide attention will be addressed during subcontractor and safety meetings.

Source Reduction

The best way to divert waste is not to create it in the first place. Before bid, before subcontract award, before construction start, and on other occasions we will discuss ways to avoid waste that result from:

- Over-packing
- Take-off errors
- Poor planning and lay-out
- Over ordering because requirements aren’t understood
• Breakage
• Mishandling
• Poor quality installation that requires tear out
• Contamination or weather damage

Of course, avoiding these mistakes saves money and makes projects run smoother, in addition to keeping material out of landfills.

From an environmental perspective, salvaging usually has a higher value than recycling, since less energy and resources are typically needed to return a salvaged item to use. We will look for opportunities to salvage materials for reuse where possible (spread on site, incorporate into the project elsewhere, donate to Habitat for Humanity). Where schedule, cost and other conditions allow, we will handle waste in this order:

1. Reuse on site
2. Salvage for reuse elsewhere
3. Recycle
4. Landfill

**Deconstruction and Salvage Opportunities**

[develop site specific deconstruction and salvage plan].

**Recycling Activities**

Subcontractor will maintain subcontractor containers in their work areas as needed to segregate subcontractor’s waste material. Subcontractors are responsible for sorting waste that results from their subcontract activities, depositing the waste in work area containers, and delivering work area containers to Project containers.

Project containers will be located on-site to facilitate use by the trades. The following separate Project containers are planned: general (non-recyclable), metal, concrete, cardboard, sheetrock, wood. may adjust the number and type of containers provided based on project requirements and recycling opportunities within the community. Signs in English and Spanish (visible from approach paths) will identify each container. The contractor will ensure proper waste segregation and fill levels of containers, spot checking containers as needed.

Costs incurred by The contractor to deposit a subcontractor’s trash in waste receptacles, or to remove trash deposited in the wrong receptacles by a subcontractor, will be invoiced to the subcontractor. If a dumpster designated for recycling is taken to the landfill because of contamination caused by a subcontractor, associated tipping fees will be invoiced to that subcontractor.

The waste management contractor (WMC) will verify prior to haul-off that material is properly sorted. The WMC will weigh loads at their transfer station or at the appropriate recycler. If no scale is available at the recycler, the WMC will record the weight of five containers of a given material at
their transfer station, then use the average of the five loads for future calculations. A master Waste Management Log will be maintained by the WMC and submitted monthly to The contractor with tickets and other supporting documentation.

Calculations

The following values from the LEED Reference Guide Version 2.1 will be used for this project if actual load weights are not available.

<table>
<thead>
<tr>
<th>Material</th>
<th>Pounds/Cubic Yard</th>
<th>Tons/Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Waste</td>
<td>350</td>
<td>5.3</td>
</tr>
<tr>
<td>Wood</td>
<td>300</td>
<td>4.5</td>
</tr>
<tr>
<td>Gypsum Wallboard</td>
<td>500</td>
<td>7.5</td>
</tr>
<tr>
<td>Steel</td>
<td>1000</td>
<td>10.0</td>
</tr>
<tr>
<td>Concrete (estimated)</td>
<td>1400</td>
<td>21.0</td>
</tr>
</tbody>
</table>
Indoor Air Quality Management Plan
New Construction

Indoor Environmental Quality Credit 3.1
Construction IAQ Management Plan
During Construction (Version 1.0)
Indoor Air Quality (IAQ) Program

Overview

Our primary focus is to keep interior pathways of the Heating, Ventilation and Air Conditioning (HVAC) system clean.

Additional objectives:

- leave only trace amounts of dust and other contaminants elsewhere in the building
- control moisture to prevent the growth of mold and other microorganisms
- use materials containing volatile organic compounds (VOC) consistent with the requirements of Leadership in Energy and Environmental Design (LEED) Credit 4.1 Low Emitting Materials.

HVAC Protection

We will delay using building HVAC systems for as long as possible, and will minimize using HVAC where dust making activities must take place inside the building (for example, when we sand drywall tape and bed joints). Permanent grilles, ductwork openings and other HVAC components requiring protection will be delivered to the jobsite shrink-wrapped, and will remain covered until just prior to installation. When air handlers are used during construction, we will ensure the return air pathway is complete (to include ensuring tiles are in place for above ceiling plenums). The mechanical contractor will:

- leak check the return air side and fix any leaks prior to operating the system
- ensure mechanical rooms are not used to store construction or waste materials
- furnish and install construction filter media at return air grilles and zone box plenum openings
- furnish and install construction filter media on top of Minimum Efficiency Reporting Value (MERV) 13 filters at air handler units on the return air side
- submit cut sheets of all filter systems used
- replace filters as needed during construction
- replace filters and clean coils prior to commissioning / test and balance
- replace filters prior to occupancy with MERV 13 filters per ASHRAE 52.2-1999
- provide digital photos with appropriate identifications to The Contractor documenting compliance with each of the steps above
In areas where dust making activity is particularly heavy, we will run air handlers at night and shut them off (or seal return air openings in the immediate area) prior to starting work. Exhaust fans will be used at building openings if needed.

Source Control

Water trucks will be used if needed to minimize site dust from the getting into the building. Fuel will be stored away from air intakes. Equipment used inside will be electric where possible. Fossil fuel powered equipment will not be allowed to idle inside the building. [Alternative wording: Fossil fuel powered equipment will not be used inside the building.]

Wet saws will be used to cut materials such as concrete masonry unit (CMU), tile, and stone. Subcontractors will control water run-off and will clean up any standing water associated with their operations. Material cutting will be done outside away from entrances and windows. If cutting inside is unavoidable, the trade doing so will install and maintain temporary dust partitions.

Finish materials (such as paint, carpet, composite wood, adhesives, and sealants) will meet Indoor Environmental Quality (IEQ) Credit 4 requirements for volatile organic compounds (VOC) and urea formaldehydes. [Alternative wording: Products with odors or significant VOC will be set up in a suitable off-site location to off-gas for a minimum of 14 days. This task is the responsibility of the contractor providing the material.] Materials with VOC’s and urea formaldehydes will not be used inside the building without prior written approval from the Architect of Record. Tools and equipment will be cleaned outside in designated areas.

Pathway Interruption

Work areas will be ventilated with outside air where excessive dust is not a problem. Areas not in use will be sealed to maintain positive pressure. Contractor will install temporary doors and partitions at building openings to keep dust out as dry in progresses. Subcontractors will cap temporary openings in their wall systems with roofing membrane to prevent water infiltration. Finished or occupied areas will be isolated as required.

Housekeeping

We will establish building access points to limit soil and trash accumulation. Crushed rock or a seal slab path will be provided from paved areas. A boot scraper and 55 gallon trash can will be placed at each entrance. A walk off mat will be placed inside each entrance point, maintained and replaced as needed. Sink materials will be protected from weather and stored in a clean, dry area before unpacking. Materials susceptible to microbial contamination that become wet will be replaced. The drywall contractor will clean drywall tracks and cavities prior to closing walls and will provide digital photos with appropriate identifications to The Contractor documenting compliance. Subcontractors will clean their work areas at the end of each day. Lunch and break areas will be
designated and provided with lined trash cans. Areas for recyclable material will be provided and maintained. The building will be swept, vacuumed, and cleaned weekly. The top of duct and piping will be cleaned halfway through construction and again prior to ceiling installation. Tobacco use will be prohibited inside of the building structure during all phases of construction.

Scheduling

Contractor will sequence installation of wet, odorous materials like paint and sealants before odor “sinks” (porous materials like ceiling tile and carpet) are installed. When this is not possible, contractor will protect sink materials with plastic. Contractor will sequence rough-in or “dirty work” to complete prior to starting finishes where possible. Project schedules will use this sequence where possible:

- fluid applied wall, ceiling and floor materials
- adhesive applied sheet and tile flooring
- adhesive applied wall covering
- carpet
- acoustical ceiling material

Building Turn Over

To comply with IEQ credit 3.2, the Owner will conduct and pay for baseline indoor air quality testing per the United States Environmental Protection Agency’s current Protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445. [Alternative wording: After construction ends, and prior to Owner occupancy, we will conduct a minimum 14 day building flush-out using new filters and 100 percent outside air.]
Indoor Air Quality Management Plan
Renovations

Reference


Scope

1) HVAC Protection – the primary goal is preventing construction dust and debris from entering the ductwork and spaces. For example, the return (negative pressure) side of the HVAC system should be isolated from the surrounding environment, especially during heavy construction/demolition. When the ventilation system needs to be operated during construction, install temporary filters, and replace them with clean media just prior to completion/occupancy. Project Manager will issue a billable work order to the PM Shop ($50 fixed).

2) Pathway Interruption – when pollutants are generated, you can use a variety of practical methods to prevent contamination. Strategies include ventilating using 100% outside air during installation of VOC emitting materials and erecting physical barriers between work areas and non-work areas. If 100% outside air is selected, Project Manager will issue a billable work order to the Control Shop with the project schedule and effected area ($25 fixed).

3) Source Control – the primary way to control sources of pollution is the use of low-emitting paints and other finishes, sealants, adhesives, and carpeting. If you use alternative products, be sure you first obtain the review and approval of the architect or project manager to confirm that substitute materials meet the requirements. Project Manager should insure the building specification requires low VOC materials (refer to RS Means Green Building: Project Planning & Cost Estimating pages 238-239 for a checklist and 240-245 for a specification shortlist – maintained in the Facilities library).

4) Housekeeping – clean frequently to remove construction dust and debris. Promptly clean-up spills. Remove accumulated water and keep work areas as dry as possible to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved. Project Manager will ensure a tack mat is used at each construction entrance – general contractor to supply, install and maintain (similar to Lab Safety High Tack Mats Catalog 2006 2nd Edition page 1394 – less than $50 per 30 sheet mat).

5) Scheduling – the goal here is to carefully control the sequence of construction to minimize the absorption of VOCs by other building materials that can act as “sinks”. For example, apply paints, sealants and other volatile materials, and allow them to thoroughly dry before installing ceiling tiles and carpet.
Project Manager

1) Complete the “Planning Checklist”
   a. Identify all potential sources of odor and dust.
   b. Locate occupied areas potentially affected by the project.
   c. Identify construction activities likely to produce detectable odor or dust in occupied areas.
   d. Classify potential IAQ problems by severity.
   e. Identify available control options
   f. Select specific control measures.

2) Notify occupants of the impending renovation at least 7 days prior to commencing the renovation. Communicate the renovation IAQ plan to the occupants that will remain in the building during any period of the renovation.

Class 1: These are air pollutants expected to have only a nuisance impact on exposed occupants. Health effects should only occur in the case of very sensitive individuals. An example is a small-scale wall relocation that will produce only small amounts of dust which contain no recognized hazards such as asbestos, lead, etc.

Class 2: These are air pollutants which could cause a moderate but temporary health impact in some occupants. An example is dust and odor from the removal and replacement of carpet or demolition of multiple walls and ceilings.

Class 3: These are more hazardous air pollutants which could cause a severe, acute, or chronic illness. Examples include disturbance of projects of combustion, asbestos fibers, heating of roof tar, application of enamel paint, mixing of epoxy resins, non-vented operation of gasoline or diesel-powered equipment, and dust from lead-based paint.
SMU Construction IAQ Planning Checklist

Project Manager _______________________________ Date ___________________

Building ___________________________ Area/Room __________________________

Project/Phase/Area Description of Work _______________________________________________________________________
________________________________________________________________________________________________________
________________________________________________________________________________________________________
________________________________________________________________________________________________________
________________________________________________________________________________________________________

1.0 Potential Emissions

1.1 Material Disturbed
1.2 New Products
1.3 Equipment Operation
1.4 System Disruption
1.5 Waste Materials

2.0 Pathway

2.1 HVAC Recirculation
2.2 Direct Exposure
2.3 Negative Pressure
2.4 Tracking
### SMU Construction IAQ Planning Checklist

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#### Instructions
For larger projects, review by phase or area (do separate checklist for each)

1.0   SMACNA IAQ Guidelines section 2.1 and 4.2 step 4. Select Class 1, 2, or 3
2.0   SMACNA IAQ Guidelines sections 2.2 and 4.2. Describe area and/or attach floor plan. Note approximate occupancy during impact. Discuss worst-case scenarios (emissions/occupancy/pathway).
3.0   SMACNA IAQ Guidelines **Chapter 3** and section 4.2. Note pros and cons of each option
University Park
Fire Department Access.

Background:
The Fire Department is required to respond to a multitude of emergencies in various types of buildings and occupancies. These include single-family dwellings, apartment buildings, shopping malls, business complexes, industrial complexes, hospitals, and nursing homes. To provide effective fire fighting operations, the Fire Department must be able to reach all structures by way of approved access roadways, streets, or driveways.

This directive shall assist developers and designers in meeting the requirements for Fire Department Access, by defining terms and listing minimum design standards considered necessary for effective fire fighting operations.

A. Defined Terms

1. Fire Department Access means an approved route that is always available for use by fire trucks and is designed to meet fire equipment load requirements. Except for loop lanes, shared driveways, and private driveways, all access routes must be at least twenty (20) feet wide. When a dead-end access route exceeds 150 feet in length, an approved turn around area must be provided.

2. Public Street Access means a Fire Department access route on a public right of way. Public street access routes must comply with the City or County road design standards and also must comply with the Uniform Fire Code.

3. Private Street Access means a Fire Department access route on private land. Private street access routes must comply with the Uniform Fire Code.

4. Grades. Street grades shall comply with City or County design standards for both Public and Private Street Access routes. Maximum grade shall not exceed 8%.

5. Grades on Turn Around Areas. Maximum grades on turn around areas shall not exceed 4%.

6. Height. All Fire Department access routes shall have at least thirteen (13) feet, six (6) inches of vertical clearance for the entire required width.

Access Guidelines

The following guidelines represent the Fire Department’s efforts to maintain consistency concerning Fire Department emergency access. It is the Department’s responsibility to ensure adequate access for Fire Department emergency responders. The City therefore reserve the right to require modifications to established requirements if, in its opinion, the access cannot be provided or may be compromised.

1. Type of Surface. All access roadways shall be finished by application of an all-weather driving surface of hot mix asphaltic concrete or concrete pavement over a flexible base capable of supporting a design wheel load of 18,000 pounds (GVW 80,000 pounds minimum; H-20 loading). The roadway design must be prepared and certified by an engineer registered by the State of Texas. Any required Fire Department access within 100 feet of any building must meet the same wheel-loading criteria. All required access roadways must be properly maintained and kept clear for emergency use at all times.
Any alternatives to these specifications must be reviewed and approved by the University Park Fire Department prior to construction.

2. Two Points of Access. Providing two points of fire apparatus access has the following benefits:

   a. If one access route is blocked, emergency responders have a second route to the property.

   b. If an emergency requires evacuation of an area, the public will have an alternative exit route should one route be blocked by the emergency incident.

When two points of access are required, they shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.

3. Commercial and Industrial Developments.

   a. Buildings or facilities exceeding 30 feet or 3 stories in height shall have at least two (2) means of fire apparatus access.

   b. Buildings or facilities having a gross building area of more than 62,000 square feet shall have at least two (2) means of fire apparatus access. If the buildings or facilities are provided with an approved automatic fire sprinkler system, the gross building area can be increased to 124,000 square feet with one access road.

C. Aerial Apparatus Roadway Width

Fire apparatus access roadways shall have a minimum unobstructed width of twenty-six (26) feet in the immediate vicinity of any building of portion of building more than thirty (30) feet in height. At least one of the required access routes meeting this condition shall be located within a minimum of fifteen (15) feet and a maximum of thirty (30) feet from the building, and shall be positioned parallel to one entire side of the building.

D. Maintenance of Access Roads

Maintenance of the required access shall be considered during the planning stages and installation of Fire Department access roadways, fire hydrants, or connections. This includes the potential growth of trees and/or other vegetation over the years.

E. Divided Entryway

A divided entryway can present a challenge to emergency vehicles. The required width of the drivable surface in a divided entryway is based on the width of the entryway and that of the street fronting it.

   1. If the street fronting the divided entryway is twenty-eight (28) feet wide, each lane of the entryway must be at least fifteen (15) feet wide.
2. If the street fronting the divided entryway is thirty-four (34) feet wide, the entryway lanes may be less than fifteen (15) feet wide, but cannot be less than twelve (12) feet wide.

3. For fronting streets wider than thirty-four (34) feet, entryway lanes must be at least twelve (12) feet wide.

F. No Parking Signage

For access routes less than twenty-eight (28) feet wide and for fire apparatus turnaround areas, vehicle parking is not allowed. **No Parking** signs are required. An approved design for the signage is shown in the Transportation Engineering Design Standards (TEDS), available from the local authority having jurisdictions.

1. For access routes sixteen (16) to twenty-two (22) feet wide, **No Parking** signs are required along both sides of the route.

2. For access routes twenty-two (22) to twenty-eight (28) feet wide, **No Parking** signs are required along one side of the route.

3. For **Hammerhead Tees** and **Alternative Turnarounds**, **No Parking** signs are required along both sides of the area.

4. For **Cul-de-sacs**, **No Parking** signs should be placed along the outside of the turnaround area.

**Standards for Construction Site Fire Safety**

These standards are intended to prescribe minimum safeguards for new building construction and significant building alteration projects in order to provide a reasonable degree of safety to life and property from fire. They are based on the provisions for fire safety during building construction as set forth in National Fire Protection Association Standard #1. This document shall not be construed to be in lieu of any other applicable State or Federal law or regulation related to construction site safety. The general contractor or other designee of the building owner shall be responsible for compliance with these standards. When the term “shall” is used in this document, it means a mandatory requirement.

**A. Fire Protection Plan**

A written Fire Protection Plan shall be developed for significant or complex construction projects at the discretion of the fire department. The plan shall be approved by the fire department prior to proceeding past foundation work for new buildings or commencement of demolition work in alteration projects. The written plan shall be consistent with the fire safety precautions as specified in this Standard. The general contractor is responsible for carrying out the provisions of the Fire Protection Plan and communicating it to all subcontractors. The Fire Protection Plan shall include the following:

1. Procedures for reporting emergencies to the Fire department.

2. Procedures for emergency notification, evacuation and/or relocation of all persons in the building under construction and on the site.

3. Procedures for hot work operations, red tag operations, management of hazardous materials and removal of combustible debris and maintenance of emergency access roads.
4. Floor plans identifying the locations of exits, exit stairs, exit routes and portable fire extinguishers.
5. Site plans identifying the designated exterior assembly areas for each evacuation route.
6. Site plans identifying required fire apparatus access roadways and on-site fire hydrants.
7. The name and contact phone number of the person(s) responsible for compliance with the Fire Protection Plan.

B. Access and Parking

1. **Fire Department Access Roadways:** All construction sites shall be accessible by fire department apparatus by means of roadways having an all-weather driving service of not less than 20 feet of unobstructed width. The roads shall have the ability to withstand the live loads of fire apparatus, and have a minimum 13½ feet (13 feet 6 inches) of vertical clearance. Dead end fire access roads in excess of 150 feet in length shall be provided with approved turnarounds. When approved by the Chief, temporary access roadways may be utilized until such time as permanent roadways are installed. As a minimum, the roadway shall consist of a compacted sub-base and 6 inches of road base material (Class 2 aggregate base rock) both compacted to a minimum 95%. The perimeter edges of the roadway shall be contained and delineated by curb and gutter or other approved method. The use of geotextile reinforcing fabric underlayment or soils lime-treatment may be required if so determined by the project civil engineer. Provisions for surface drainage shall also be provided where necessary. The integrity of the roadway shall be maintained at all times.

2. **Premises Identification:** The address numbers of the property or project location shall be plainly visible and legible from the street or road fronting the property at the fire apparatus access point or as otherwise approved.

3. **Vehicle Parking:** All vehicles shall be parked a minimum of 20 feet from new buildings under construction.

C. Fire Protection Systems

1. **Fire Hydrants:** Where underground water mains and hydrants are required for the building(s) under construction, they shall be installed, completed, and in service prior to combustible construction materials accumulating on site.

2. **Standpipes:** Where standpipes are required, the standpipes shall be installed when the progress of construction is not more than 35 feet in height above the lowest level of the fire department access. Standpipes shall be provided with fire department hose connections and outlets at accessible locations adjacent to usable stairs. The standpipe system shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring. Each floor shall be provided with a 2½-inch valve outlet for fire department use. Where construction height requires installation of a Class III standpipe, fire pumps and water main connections shall be provided to serve the standpipe.

3. **Area Separation Walls:** When area separation walls are required, the wall construction shall be completed (with all openings protected) immediately after the building is sufficiently weather-protected at the location of the wall(s).


6. Fire Extinguishers: Refer to Fire Extinguishers, Part B-4-29.

7. Smoking: Smoking is prohibited anywhere inside or on the roof of new buildings under construction or in the project work area of buildings undergoing alteration. A suitable number of 'No Smoking' signs shall be posted to ensure that smoking is controlled.

8. Telephone Service: Provisions shall be provided at the construction site for emergency notification of the fire department via telephone. The street address of the construction site shall be posted adjacent to the telephone, along with the number for the public safety answering point.

D. Exit Requirements

1. Minimum Number of Exits: All new buildings under construction shall have at least one unobstructed exit.
   All exits shall be identified in the Fire Protection Plan.

2. Multi-Story Buildings: Each level above the first story in new multi-story buildings shall be provided with at least two usable exit stairs after the floor decking is installed. The stairways shall be continuous and discharge to grade level. Stairways serving more than two floor levels shall be enclosed (with openings adequately protected) after exterior walls/windows are in place. Exit stairs in new and in existing, occupied buildings shall be lighted and maintained clear of debris and construction materials at all times.

3. Assembly Points: Designated exterior assembly points shall be established for all construction personnel to relocate to upon evacuation. The assembly points shall also be identified in the Fire Protection Plan.

E. Flammable and Combustible Liquids

1. Storage Areas: The following requirements shall apply to storage areas for flammable and combustible liquids:
   a. Storage areas shall be kept free of weeds and extraneous combustible material.
   b. Open flames and smoking shall be prohibited in storage areas.

2. Containers: Metal containers for Class I or II liquids shall be in accordance with DOT requirements or shall be of an approved design. Discharge devices shall not cause an internal pressure on the container. Individual containers shall not be interconnected and shall be kept closed when not in use.

3. Secondary Containment: Secondary containment or a means of spill control, drainage control, and diking shall be required for containers and tanks as approved by the fire department and, if applicable, local hazardous materials program agency.

4. Marking: Tanks and containers shall be marked with the name of the product and “FLAMMABLE — KEEP FIRE AND FLAME AWAY.” Tanks (i.e., containers in excess of 60 gallons) shall also be labeled “KEEP 50 FEET FROM BUILDINGS.”
5. **Tank Installation Plans/Permit:** Plans for the installation/use of any aboveground storage tank (i.e., container greater than 60 gallons) shall be submitted to the fire department and, if applicable, local hazardous materials program agency for review and permit prior to the proposed tank arriving at the site.

**F. Other Combustible Materials**

1. **Combustible Material Storage:** Combustible construction materials shall be stored a minimum of 20 feet from buildings under construction or undergoing remodel.

2. **Combustible Debris:** Wood, cardboard, packing material, form lumber, and similar combustible debris shall not be accumulated within buildings. Such debris, rubbish, and waste material shall be removed from buildings on a daily basis.

3. **Oily Rags:** Oily rags and similar material shall be stored in metal or other approved containers equipped with tight-fitting covers.

**G. Compressed Gases**

1. **Protection of Gas Containers:** Gas containers/cylinders shall be protected as follows:
   a. Combustible materials shall be kept a minimum of 10 feet from gas containers.
   b. Cylinders shall be protected against physical damage.
   c. Cylinders shall be stored upright and secured to prevent falling.
   d. Cylinders shall not be placed near elevators, unprotected platform edges or other areas where they would drop more than 2 feet.
   e. Cylinders shall not be placed in areas where they may be damaged by falling objects.
   f. When cylinders are not in use, valve protective caps shall be in place.
   g. Ropes, chains or slings shall not be used to suspend gas cylinders, unless the cylinder was manufactured with appropriate lifting attachments.

2. **Separation:** When stored, gas cylinders shall be separated from each other based on their hazard classes.

3. **Marking:** Gas cylinders shall be marked with the name of the contents.

**H. Liquefied Petroleum Gas (LP-Gas)**

1. **Use in Buildings:** Propane containers may be used in buildings under construction or undergoing major renovation as a fuel source for temporary heating for curing concrete, drying plaster and similar applications in accordance with the following:
   a. Heating elements (other than integral heater-container units) shall be located at least 6 feet from any LPGas container.
   b. Integral heater-container units specifically designed for the attachment of the heater to the container, or to a supporting standard attached to the container, may be used provided they are designed and installed so as to prevent direct or radiant heat application to the LP-Gas container.
   c. Blower and radiant type units shall not be directed toward any LP-Gas container within 20 feet.
   d. Heat producing equipment shall be installed with clearance to the combustibles in accordance with the manufacturer's installation instructions.
   e. Cylinders shall comply with DOT cylinder specifications and shall be secured in an upright position.
f. Regulators shall be approved for use with LP-Gas. Fittings shall be designed for at least 250 p.s.i.g. service pressure.
g. Hose shall be designed for a working pressure of at least 350 p.s.i.g. (unless limited to 5 p.s.i.g.) and shall be a maximum of 6 feet in length.
h. Portable heaters shall be equipped with an approved automatic device to shut off the flow of gas to the main burner and to the pilot in the event of flame extinguishment or combustion failure. Portable heaters with an input of more than 50,000 Btu/hr shall be equipped with either a pilot that must be proved before the main burner can be turned on or an approved electronic ignition system.

2. Occupied Buildings: In addition to the above, for LPG storage/use in buildings undergoing alteration and that are fully or partially occupied, the following shall also apply:
   a. Specific approval must be obtained from the fire department prior to bringing LP-Gas containers on-site.
   b. The maximum water capacity of individual containers shall be 5-gallon water capacity and the number of containers in the building shall not exceed the number of workers assigned to using the LP-Gas.
   c. Containers having a water capacity greater than 2½ pounds (1 quart) shall not be left unattended.

I. Hot Work

Hot work includes any work involving operations capable of initiating fires or explosions, including cutting, welding, brazing, soldering, grinding, thermal spraying, thawing pipe, torch applied roofing, or any other similar activity. The use of hot work equipment shall be in accordance with the following requirements, including a pre-site inspection, fire watch and post inspection procedures, and in accordance with the University’s insurers’ specifications.

1. Pre-Site Inspection: An inspection of the hot work site shall be conducted by the General Contractor or his/her designee prior to hot work operations to ensure that:
   a. Hot work is completed.
   b. The hot work site is clear of combustibles or that combustibles are protected;
   c. Exposed construction is of noncombustible materials or that combustible materials are protected;
   d. Openings are protected;
   e. There are no exposed combustibles on the opposite side of partitions, walls, ceilings, floors, etc.
   f. Fire extinguishers are available, fully charged and operable; and
   g. Fire watch personnel are assigned, equipped and trained.

2. Fire Watch: The sole duty of fire watch personnel shall be to watch for the occurrence of fire during and after hot work operations. Individuals designated to fire watch duty shall have fire extinguishing equipment readily available and shall be trained in the use of such equipment. Personnel assigned to fire watch shall be responsible for extinguishing spot fires and communicating an alarm. Hot work conducted in areas with vertical and horizontal fire exposures that cannot be observed by a single individual shall have additional personnel assigned to fire watches to ensure that all exposed areas are monitored.

3. Post-Work Inspection: The fire watch shall be maintained a minimum of 60 minutes after the conclusion of the work to look out for leftover sparks, slag or smoldering combustibles.
J. Special Equipment

1. **Motorized Equipment:** Motorized equipment, including internal-combustion-powered construction equipment, shall be used in accordance with the following:
   a. Fuel for equipment shall be stored in an approved area outside of the building.
   b. Equipment shall not be refueled while in operation.
   c. Equipment shall be located so that exhausts do not discharge against combustible materials.
   d. When possible, exhausts should be piped to the outside of the building.

2. **Temporary Heating Equipment:** Temporary heaters, such as those that are LPG fueled, shall be listed and shall be installed, used, and maintained in accordance with the manufacturer's instructions (See LPG storage and use requirements, above). Heating devices shall be secured properly and kept clear from combustible materials. Refueling operations shall be conducted in an approved manner.

3. **Asphalt and Tar Kettles:** Asphalt kettles shall not be located within 20 feet of any combustible material, combustible building surface or building opening. With the exception of thermostatically controlled kettles, an attendant shall be within 100 feet of a kettle when the heat source is operating. Ladders or similar obstacles shall not form a part of the route between the attendance and the kettle. Kettles shall be equipped with tight-fitting covers. A minimum 20-B:C rated portable fire extinguisher shall be located within 30 feet of each asphalt kettle when the heat source is operating. Minimum 20-B:C rated portable fire extinguishers also shall be located on roofs during asphalt coating operations.
Trash and Recycling Locations
SECTION 16700
COMMUNICATIONS
OUTSIDE PLANT CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. This standard is intended for all “standard” installations at the Dallas and Plano campuses and is not intended to address special installations that are sometimes encountered and addressed on an individual basis.

B. This section includes specifications of Customer-Owned Outside Plant Communications cabling, terminations, pathways, installation methods and hardware specifications that apply to the Outside Plant Structured Cabling System (OSP-SCS – See Definition Below).

C. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant OSP-SCS.

1.2 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:
   a. National Electrical Code (NEC)
   b. National Electrical Safety Code (NESC)
   c. Occupational Safety and Health Act (OSHA)

2. Communications:
   a. ANSI/TIA/EIA - 455: Fiber Optic Test Standards
   b. ANSI/TIA/EIA - 526: Optical Fiber Systems Test Procedures
   c. ANSI/TIA/EIA - 568-B: Commercial Building Telecommunications Cabling Standard
   d. ANSI/TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
   e. ANSI/TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   f. ANSI/TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
   g. ANSI/TIA/EIA - 758: Customer-Owned Outside Plant Telecommunications Cabling Standard
   h. ISO/IEC IS 11801: Generic Cabling for Customer Premises
   i. BICSI: BICSI Telecommunications Cabling Installation Manual
   j. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)
   k. BICSI: BICSI Customer-Owned Outside Plant Design Manual
1.3 DEFINITIONS

A. “OSP-SCS” shall mean Outside Plant - Structured Cabling System. The OSP-SCS is defined as all required equipment and materials including, but not limited to, ANSI/TIA/EIA and ISO/IEC compliant copper and fiber optic cable (multimode and singlemode), connectors, splices, splice closures and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

B. “MH” shall mean Maintenance Holes or Hand holes used for the routing of communications cables.

C. “TMGB” shall mean Telecommunications Main Grounding Busbar. There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground by the electrical contractor. (Shall be installed by the electrical contractor.)

D. “TGB” shall mean Telecommunications Grounding Busbar. There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems. (Shall be installed by the electrical contractor.)

E. “TBB” shall mean Telecommunications Bonding Backbone. The TBB is a conductor used to connect TMGBs to TGBs. (Shall be installed by the electrical contractor.)

F. “EMT” shall mean Electric Metallic Tubing. For entry conduits and tunnel raceway. (Shall be installed by the electrical contractor.)

G. “PVC” shall mean Polyvinyl Chloride Pipe. For buried conduits. (Shall be installed by the electrical contractor.)

H. “BEP” shall mean Building Entrance Protection. For Lightning Protection after OSP enter a building.

I. “MDF” shall mean Main Distribution Frame. Located in Patterson Switch Room.

J. “BDF” shall mean Building Distribution Frame. Usually located in the basement of a building. Houses the telecomm equipment for the building and connects to Patterson MDF.

K. “IDF” shall mean Intermediate Distribution Frame. Connects floors in a building to the building BDF.

1.4 SUBMITTAL INFORMATION

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.
2. For those items noted as allowing “or equal,” and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written request to substitute and description detailing the reason for the substitution.

3. Provide standard manufacturer’s cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in.

B. Quality Assurance/Control Submittals: Provide submittal information for review as follows:

1. Submit a cable routing and grouping plan as follows:
   a. Where the cable routing and grouping is to be provided as shown on the Contract Documents, do not provide a cable routing and grouping plan. Submit written documentation stating that the cable routing and grouping will be provided as shown on the Contract Documents, that the Contractor has reviewed the routing and grouping on the Contract Documents, and that the routing and grouping meets applicable codes, regulations and standards.
   b. Where changes in cable routing and grouping are proposed, ensure that any cabling changes are coordinated with comparable accommodating changes to the raceway routing and grouping. Discuss each location where the proposed routing and grouping are different from the Contract Documents with the SMU Infrastructure Design Engineer prior to installation for approval.

2. Submit a list of proposed test equipment for use in verifying the installation of the OSP-SCS. Proposed test equipment shall meet the criteria as stated in PART 3 – TESTING.
   a. Submit for each testing device:
      1) Manufacturer and product number.
      2) Documentation from the manufacturer showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the manufacturer’s recommended calibration period, encompassing the period of time when the testing device will be used on this project.
      3) Documentation from the manufacturer showing software revision. Software revision shall be most current revision available for the device and shall be based upon the most current ANSI/TIA/EIA testing guidelines.
   b. Submit proposed copper and fiber cable test forms (see PART 3 – TESTING for more detail).

C. Closeout Submittals: Provide submittal information for review as follows:

1. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the SMU Infrastructure Design Engineer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.

2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of markups of drawings, specifications and spreadsheets.
a. Document changes to the system from that originally shown on the Contract Documents.
b. Keep Record Drawings at the job site and make available to the Owner at any time.
c. Keep Record Drawings current throughout the course of construction. (“Current” is defined as not more than one week behind actual construction).
d. Provide the Owner at time of completion a set of As-Builts. Showing all distribution frames, station locations and pathways.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications: Prior to bidding the project, submit:
   1. The Bidding Contractor must be a certified local Systimax Var.
   2. Documentation from the OSP-SCS manufacturer demonstrating that the Contractor is trained and certified by BICSI, Systimax Solutions to install, test, and maintain the OSP-SCS to provide the Manufacturer’s Warranty (see PART 1 - WARRANTY).
      a. BICSI Technician (for general understanding of all cabling codes, standards and practices)
      b. Systimax Solutions (for fiber and copper)
   3. Documentation indicating that the Contractor will have a minimum of one BICSI Technician, Systimax Solutions manufacturer-trained and manufacturer-certified employee perform installation, testing, and firestopping work, as detailed below.
   4. Documentation indicating that the Contractor will have all Systimax Solutions manufacturer-trained and manufacturer-certified employees performing installations of any copper media, as detailed below.
   5. Documentation demonstrating that the Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD), certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). The document shall also declare that the Contractor will continue to employ a minimum of one RCDD throughout the duration of the project.

B. Contractor’s employees directly involved with the supervision, installation, testing, and certification of the OSP-SCS shall be trained and certified by Systimax Solutions. Training and certifications by employee type are required as shown below:
   1. Supervisors/Project Foremen: All (100%) shall be a certified BICSI Technician and manufacture trained/certified for installation and testing of Systimax Solutions products.
   2. Installation Technicians: All (100%) shall be manufacture trained/certified for installation Systimax Solutions products.

1.6 WARRANTY

A. Contractor Warranty:
   1. Provide a Contractor-endorsed ten-year service warranty against defects in materials and workmanship.
      a. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.
      1) The Contractor Warranty period shall commence upon Owner acceptance of the work.
B. OSP-SCS Manufacturer Warranty:
   1. Provide a OSP-SCS Manufacturer extended product, performance, application, and labor warranty that shall warrant all passive components used in the OSP-SCS. Additionally, this warranty shall cover components not manufactured by the OSP-SCS Manufacturer, but approved by the OSP-SCS Manufacturer for use in the OSP-SCS (i.e. “Approved Alternative Products”). The OSP-SCS Manufacturer warranty shall warrant:
      a. That the products will be free from manufacturing defects in materials and workmanship.
      b. That the cabling products of the installed system shall meet or exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
      c. That the installation shall meet or exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
      d. That the system shall support both current and future applications that use the ANSI/TIA/EIA 568-B and ISO/IEC 11801 component and link/channel specifications for cabling.
   2. Provide materials and labor attributable to the fulfillment of this warranty at no cost to the Owner.
   3. The OSP-SCS Manufacturer Warranty shall be provided by the selected OSP-SCS Manufacturer and shall be:
      a. Systimax Solutions 10-year System Warranty
         1) Provide a copy of the warranty registration document to the Owner at the time of submittal to Systimax Solutions.
   4. The OSP-SCS Manufacturer Warranty period shall commence upon a Warranty Certificate being issued by the manufacturer. The Warranty Certificate shall be issued no later than three months after Owner acceptance of the work.

PART 2 - PRODUCTS

2.1 GENERAL

   A. Unless otherwise noted, provide items as specified. “Or equal” or equivalent items are not acceptable.

   B. Physically verify existing site conditions prior to work start, including but not limited to lengths and condition of conduit and/or pathway (including tunnels, maintenance holes and hand holes) to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.

   C. OSP-SCS components shall be manufactured by a single manufacturer. Components shall not be intermixed between different manufacturers unless the manufacturer of the OSP-SCS has listed (in writing) another manufacturer’s component as an “Approved Alternative Product” and will warrant the “Approved Alternative Product” as part of the OSP-SCS Manufacturer Warranty (see PART 1 - WARRANTY).

   D. Bid only one OSP-SCS Manufacturer and only bid a manufacturer for which the Contractor is certified. The OSP-SCS Manufacturer shall be the following. Substitution is not acceptable:
      1. Systimax Solutions/ComScope (for copper cabling)
      2. Systimax Solutions/ComScope (for fiber optic cabling)
E. For a given manufacturer, all components shall be part of a single OSP-SCS product line – components shall not be intermixed between a manufacturer’s OSP-SCS product lines. The OSP-SCS product line shall be engineered “end-to-end” – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

2.2 PATHWAYS AND RACEWAY

A. Acceptable fiber raceway:
   1. Innerduct:
      a. Outside Plant: Corrugated, bright orange, and rated for outdoor duct installation.
         1) 1” Diameter
         2) 1-1/2” Diameter
      b. Intrabuilding: Corrugated, bright orange or white, and rated for indoor installation.
         1) 1” Diameter - plenum rated
         2) 1-1/4” Diameter - plenum rated
      c. Innerduct is not required if armored steam rated fiber applies.

2. Conduit and Duct Requirements:
   a. All conduits and cable ducts placed for SMU will be clean and free of moisture prior to acceptance by the SMU OIT department. A letter of certification is to be provided by the conduit or cable duct installation contractor verifying the testing and condition of the conduits and cable ducts.
   b. All innerduct and conduit pathways must have pull strings/ropes installed by the contractor at the time of conduit pathway installation.
   c. Conduit Composition:
      1) Conduits placed in tunnels shall be metallic. (EMT)
      2) Buried conduits can be PVC with pull boxes or hand holes. (All bends/sweeps must be metallic)
   d. A minimum of (3) 4 inch entry conduits from the outside utility tunnel, pull box or manhole that terminates above the finished floor in the building BDF, however there may be buildings that require more capacity based upon specific requirements or population density. The entrance capacity for all new buildings should be verified with the SMU Infrastructure Design Engineer.
   e. Bends/Sweeps:
      1) A standard of 8 inch bend/sweep per 1 inch of conduit diameter will be followed. (For instance: A 2 inch conduit must have a 16 inch 90 degree bend/sweep applied.)
   f. Pull Boxes/Hand Holes:
      1) Size vs. Pipe Size
      2) Indoor: A pull box will be placed every 100 feet of conduit or after 180 degrees of bends/sweeps have been met.
      3) Outdoor: A pull box/hand hole will be placed after every 300 feet of conduit if no significant bends/sweeps are made. For every 90 degrees of bends/sweeps, 50% of the total conduit length between pull box/hand hole will be subtracted. (For instance: A conduit path with a 90 degree turn will have a pull box/hand hole placed after 150 feet of conduit.)
4) Depth

3. Buried Conduits:
   a. 1 inch is the minimum acceptable conduit size, however there may be buildings that require more capacity based upon specific requirements or population density. The entrance capacity for all new buildings should be verified with the SMU Infrastructure Design Engineer.
   b. Conduit pathways must have pull strings/ropes installed by the contractor at the time of conduit pathway installation.
   c. A pull box/hand hole will be placed after every 300 feet of conduit if no significant bends/sweeps are made. For every 90 degrees of bends/sweeps, 50% of the total conduit length between pull box/hand hole will be subtracted. (For instance: A conduit path with a 90 degree turn will have a pull box/hand hole placed after 150 feet of conduit.)
   d. Depth:
      1) 24 inches below the surface is the minimum accepted.
      2) 30 inches below the surface is acceptable.
      3) 36 inches below the surface is preferred.
   e. A yellow marker tape is to be placed 12 inches below the surface running the length of the conduit path.
   f. Separation shall be 12 inches minimum, 18 inches preferred from any electrical equipment or lines.
   g. Conduit Composition:
      1) PVC with pull boxes or hand holes will be acceptable. (All bends/sweeps must be metallic.
      2) NO LB’s, electrical or steam elbows will be accepted in a non-accessible conduit path.)
      3) LB’s are sometimes used to enter building. These instances will be addressed and approved on an individual basis by the SMU Infrastructure Design Engineer.
   h. Trenching: Structure of trench and filling materials
      1) Layer 1 (Base Fill): A porous material suitable for drainage.
      2) Layer 2 (Conduit): Installation of required conduits.
      3) Layer 3 (50/50 mix): mix of base fill and clean fill.
      4) Layer 4 (Clean Fill): To the surface.
      5) A yellow marker tape is to be placed 12 inches below the surface running the length of the conduit path.
      6) Compaction testing: 90% native ground, 95% roadways.

4. Tunnel Environments:
   a. Space Requirements:
      1) Appropriate access must be installed allowing an able bodied individual to move in and out of the tunnel spaces.
      2) Access hatches/grates must have a locking mechanism or the ability to have a pad lock installed.
      3) Racking: As available.
      4) Distances from others
         a) A separation of 12 inches minimum shall be maintained, 18 inches preferred from electrical equipment and lines and parallel runs.
         b) Tunnel temperatures are not to exceed 176 degrees Fahrenheit or fall below -49 degrees Fahrenheit. If tunnel temperatures do not
meet the requirements, proper ventilation/insulation will need to be installed.

5. Vaults:
   a. Racking: As required
   b. Drainage: Proper drainage shall be installed to keep standing water from tunnel spaces.

2.3 CABLING METHODS

A. Buried
   1. Pathway/Route is to be accepted by the SMU Infrastructure Design Engineer.
   2. Bends are not to exceed 4 times the outside diameter of the cable being installed.
   3. Conduit Depth
   4. Conduit Composition
   5. A yellow tape marker is to be placed 12 inches below the surface that runs the length of the conduit path.
   6. Cable Composition
   7. Lightning Protection
   8. Splicing

B. Direct Burial (not an SMU preferred cabling method)
   1. Pathway/Route is to be accepted by the SMU Infrastructure Design Engineer.
   2. Bends are not to exceed 4 times the outside diameter of the cable being installed.
   3. Cable Depth:
      a. 36 inches below the surface is preferred.
      b. 30 inches below the surface is standard.
      c. 24 inches below the surface is the minimum that will be accepted.
      d. A yellow tape marker shall be placed 12 inches below the surface running the length of the cable path.
   4. Direct Buried Cable Composition:
      a. Must be gel filled (encapsulated) and meet outside plant requirements.
   5. Lightning Protection:
      a. BETs shall be placed at each end of the OSP-SCS. Cables must terminate on BETs after 50 feet from entry. From BET, continue the circuit with the approved plenum rated cable to the buildings BDF if necessary.
      b. See section 2.4 (TERMINATION EQUIPMENT) for detailed hardware specifications.
   6. Splicing:
      a. A buried splice case is not acceptable; splice casing must be placed in an accessible location.

C. Aerial (not an SMU preferred cabling method)
   1. Route/Pathway: Contact the SMU Infrastructure Design Engineer prior to any aerial installations.
   2. Bends
   3. Splicing
   4. Lightning Protection:
      a. BEPs shall be placed at each end of the OSP-SCS. Cables must terminate on BEPs after 50 feet from entry. From BEP, continue the circuit with the approved plenum rated cable to the buildings BDF if necessary. (If OSP
cables are placed in a welded joint rigid conduit it may continue the OSP rated cable run into the building and terminate on a BEP upon entry to the plenum environment).

b. See section 2.4 (TERMINATION EQUIPMENT) for detailed hardware specifications.

5. Aerial Cable Composition:
   a. Must meet outside plant requirements.

6. Supporting Strands:
   a. A metallic stranded cable may be required to support the aerial cable across poles and attach to the end user building if one is not present.
   b. Contact the SMU Infrastructure Design Engineer prior to any stranded cable installations for specification on where to secure to the poles and user buildings.

2.4 TERMINATION EQUIPMENT

A. Voice Backbone - Copper Building Entrance Terminals (BETs) in Patterson Switch Room (MDF). Complete with 25 foot minimum stub and plug-in gas protector modules (3BIE) for each pair terminated on the chassis. BETs and protectors shall be manufactured by the following manufacturer:
   1. For Circa Enterprises, Inc. – Patterson Switch Room (MDF):
      a. 1880B1 Series with 3BIE gas protectors
         1) 100-pair to be terminated: 1880B1-100

B. Voice Backbone - Copper Building Entrance Terminals (BETs) in User Buildings (BDF). Complete with lockable covers and plug-in gas protector modules (3BIE) for each pair terminated on the chassis. BETs and protectors shall be manufactured by the following manufacturer:
   1. For Systimax Solutions – User Buildings (BDF):
      a. Systimax Solutions 489 Series with 3BIE gas protectors
         1) 100-pair to be terminated: 489ACA1-100

C. Copper Splice Closures: Closures shall be re-enterable without the destruction of the housing. Closures shall be complete with all incidental and/or required hardware including, but not limited to, cans, end caps, grommet kits, covers, splice connectors, and grounding/bonding hardware. Closures shall not require special tooling for entry and sealing of the closure.
   1. Outdoor: Splice closure shall have a stainless steel shell and shall be watertight sealable.
      a. Closures shall be, regardless of the selected OSP-CCS Manufacturer:
         1) 3M or a better built casing is acceptable.
      b. Encapsulation: Waterblocking compound per manufacturer’s recommendation.
   2. Indoor:
      a. Closures shall be, regardless of the selected OSP-CCS Manufacturer:
         1) 3M or a better built casing is acceptable.

D. Fiber Splice Closures:
   1. Outdoor:
      a. Shall be outdoor rated and re-enterable without the destruction of the housing. Closures shall not require special tooling for entry and sealing of
the closure. Closures shall be complete with all incidental and/or required hardware including, but not limited to end caps, grommet kits, splice trays, and grounding/bonding hardware. Closures shall be either butt or in-line depending upon the application.

b. No mechanical splices are to be performed and will not be accepted.
c. Fusion splicing is the only SMU accepted splicing method, except where approved by the SMU Infrastructure Design Engineer.

2. Indoor:
   a. 3M or a better built is acceptable.
   b. No mechanical splices are to be performed and will not be accepted.
   c. Fusion splicing is the only SMU accepted splicing method, except where approved by the SMU Infrastructure Design Engineer.

E. Fiber Shelves:
   1. Patterson Switch Room (MDF):
      a. Systimax Solutions fiber shelf with Commscope pigtails fusion spliced, LC Connectors. Use high density coupler panel. (see section 2.4 part F for coupler panel specifications)
      b. Systimax Solutions fiber shelf with Commscope pigtails fusion spliced, LC Connectors. Use high density coupler panel. (see section 2.4 part F for coupler panel specifications)

   2. Building BDF:
      a. Systimax Solutions fiber shelf with G2 Modules (see section 2.4 part F for coupler panel specifications)
      b. Systimax Solutions fiber shelf with G2 Modules (see section 2.4 part F for coupler panel specifications)

F. Fiber Connector Panels: (MDF & BDF)
   1. All 62.5μm MM strands assigned by OIT as Voice/Data fiber are to be fusion spliced (LC) pigtails with Commscope high density coupler panel.
   2. All 50μm MM strands assigned by OIT as Data fiber are to be fusion spliced (LC) pigtails with Commscope high density coupler panel.
   3. All 8μm SM strands assigned by OIT as Data fiber are to be fusion splice to (LC) pigtails with Commscope high density coupler panel.

2.5 CABLE

A. Outdoor Cable: Rated for outdoor and steam tunnel use, duct installation, aerial, and/or direct burial installation as dictated by the application.
   1. Fiber Optic Cable: All-dielectric, meeting or exceeding ANSI/TIA/EIA and industry standards. Cables and fan-out kits shall be manufactured by the selected OSP-SCS Manufacturer:
      a. Multimode: All-dielectric, multimode graded index, 62.5/125 multimode.
         1) For Systimax Solutions:
            a) Indoor rated:
            b) Outdoor rated:
            c) Armored/Steam rated:
      b. Multimode: All-dielectric, multimode graded index, 50/125 multimode.
         1) For Systimax Solutions:
            a) Indoor rated:
b) Outdoor rated:
c) Armored/Steam rated:

c. Singlemode: All-dielectric, singlemode graded index, 8/125 singlemode.
   1) For Systimax Solutions:
      a) Indoor rated:
      b) Outdoor rated:
      c) Armored/Steam rated:

d. Hybrid/Composite: Conform to the Multimode and singlemode characteristics above.
   1) For Systimax Solutions:
      a) Indoor rated:
      b) Outdoor rated:
      c) Armored/Steam rated:

d) Copper Cable:
   a) For Backbone: Shielded, with 24-AWG solid copper conductors insulated with color coded PVC. Minimum pair count of 100 unless otherwise specified by the Contract Documents. UL Verified to ANSI/TIA/EIA 568-B for Category 3 performance. Cable shall be manufactured by or listed as an “approved alternative product” by the selected OSP-SCS Manufacturer:
      Systimax Solutions: [__________]

2.6 LABELING AND ADMINISTRATION

A. Labels
   1. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

Labeling Standards for SMU Southern Methodist University has created its own unique labeling scheme to quickly identify the location of all jacks within a building. The labeling scheme consists of an 11 digit code (Ex. 00-00000-0000). This label will be shown on all locations within the telecommunication closets (patch panels, 110 blocks), and also required on all jacks in the field (faceplates, surface mount boxes). Each label will consist of 3 sections to the label. Each label represents crucial information such as floor, room, direction on a wall, jack location within the faceplate, voice or data within a faceplate, and the voice or data number within the faceplate.

Section 1 Building floors (00-00000-0000)
This section will represent the floor number for the designation location of the station jack location.
   • For example, a label stating 03-00305-WAD1 shows that the station data resides on the 3rd floor of a building.

Section 2 Room numbers (00-00000-0000)
This section will represent the room number where the station jack is located.
   • For example a label with the room number 305 would be expressed as 03-00305-WAD1
   • In the event a jack does not reside in a room represented by a number, other labels will apply:
     o Mechanical room- typically stated a 02-0MECH-WAD1
     o Hallway/ Corridor –typically stated as 02-201CR-WAD1
Lobby- typically has a room number such as 201 (ex. 02-201LB-WAD1)
- When labeling a faceplate, Section 1 & 2 will be displayed in large font in the window of the faceplate.

**Section 3** Directional, location, jack type, jack number (00-00000-1234)
Each of the last 4 digits in the labeling scheme identifies particulars within the faceplate. Each faceplate will show the last 4 digits of this identifier underneath each jack.

1) Directional label
   - The **1** in the last four digits of 00-00000-1234 represents the direction in which the voice/data jack is located within a room. These are represented as:
     - West = W
     - North= N
     - East = E
     - South= S
     - Floor = F (cables rise from a floor penetration)
     - Ceiling= C (cables terminate in ceiling) Grid label required
     - Middle=M (cables route down in a power pole of isolated column)
   - For example a data jack located on the north wall of room 305 would be shown as 03-00305-NAD1.

2) The **2** in the last 4 digits of (00-00000-1234) represents the faceplate number on the wall.
   - Faceplates should be labeled reading **Left to Right** on a given wall. **A** will represent the 1st faceplate location on a wall, **B** will represent to the 2nd faceplate location on the same wall, **C** the 3rd and so on.
     - For example, a data jack in the 5th faceplate on the same wall, counting left to right will be labeled as (01-00100-NED1)

3) Type of telecommunication outlet (00-00000-1234)
   - The **3** in the last 4 digits of (00-00000-1234) represents the type of telecommunications jack installed.
     - This will be shown as a **V** or a **D**
       - **V** is for Voice outlet (White jack)
       - **D** is for Data outlet (Blue jack)
   - For example a data jack will be shown as 01-00100-WAD 1

4) Jack number (00-00000-0000)
   - The **4** in the last 4 digits of (00-00000-1234) represents the number of the same type of jack (voice or data) within a faceplate.
     - A typical faceplate will express this number as 1-6.
       - For example, the 5th data within a faceplate will be expressed as 01-00100-WAD5

**Exceptions:** Cameras, Building Automation Systems, Access control & Wireless access points
- The label for cameras will have unique identifier for section 3 of its label. (00-00000-CAM1)
  - Cameras will be labeled as **CAM**. The number “1” shown in the example represents the 1st camera located in the room. Every camera added will be
labeled as CAM2, CAM3 and so on. The full label should be placed on the mounting bracket of the camera and be visible from the ground.

- The label for building automation boxes will be shown as (00-00000-BAS1).
  - Building automation locations will be labeled as BAS. The number “1” shown in the example represents the 1st data within the building automation enclosure.
    - It is required that a label be placed on the exterior of the enclosure to assist with locating the jack
- The label for building automation boxes will be shown as (00-00000-ACC1).
  - Access control – Access control locations will be labeled as ACC. The number “1” shown in the example represents the 1st data within the access control enclosure.
    - It is required that a label be placed on the exterior of the enclosure to assist with locating the jack
- Contact SMU Infrastructure design engineer for exterior wireless bollard labels

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Store all materials so as to be protected from the elements. The Contractor shall be responsible for any deteriorating effects on the materials due to improper storage (or outdoor storage) prior to installation including damage caused by prevailing weather conditions.

G. Remove surplus material and debris from the job site and dispose of legally.
3.2 RACEWAY

A. Outside Plant Innerduct (see section 2.2 - PATHWAYS AND RACEWAY for detailed specifications):
   1. Provide sufficient innerduct slack to allow for innerduct shrinkage after stretching during installation.
   2. Avoid excessive pulling tension. Replace corrugated innerduct showing evidence of excessive pulling tension at no cost to the Owner.
   3. Rack and secure innerduct inside maintenance holes and handholes. If existing maintenance holes and handholes have insufficient racking to support new cabling, provide racking.
   4. Cap innerduct immediately after placement in order to prevent debris from entering. Uncap only when cable is to be installed.

B. Inside Plant Innerduct (see PATHWAYS AND RACEWAY for detailed specifications):
   1. Provide plenum-rated innerduct within plenum rated spaces once the OSP fiber has entered the building.

3.3 TERMINATION EQUIPMENT

A. Copper Building Entrance Protectors: Provide BEPs in types, sizes and quantities as shown on the Contract Documents and as required for protection of building-to-building copper circuits. Provide BEPs in sufficient quantity to protect each pair of each. Install BEPs per manufacturer’s instructions. Route outside plant copper cables through a BEP.
   1. Connect each BEP’s protector ground lug to the nearest TGB with a #6 AWG copper grounding conductor.

3.4 SPLICE CLOSURES

A. OSP Copper Splice Closures: Provide copper splice closures in sizes and quantities as shown on the Contract Documents with suitable connectors. Do not install splice closures where not shown on the Contract Documents. Install closures per manufacturer’s instructions. Closures shall be sized to accommodate the quantity of pairs to be spliced. Closures shall be outdoor or indoor rated (depending upon the use).
   1. Splice closures located in maintenance holes/tunnels shall be supported on racks (at both ends) and shall be located to avoid blocking duct/tunnel access. Splice closures shall not be installed in hand holes unless authorized by the SMU Infrastructure Design Engineer.
   2. Prior to sealing closure, electrically test each cable pair for opens, shorts, crosses and grounds.
   3. Cable shields/sheaths shall be connected together at all splices and termination points to assure a continuous metallic shield, and shall also be connected to the grounding conductor if located in a maintenance hole/tunnel. Electrically test the shield/sheath continuity. Connect each closure’s ground lug to the nearest TGB with a #6 AWG copper grounding conductor.
   4. Closures shall be properly sealed and demonstrated watertight without encapsulant. Test seals after closure by pressurizing the closure and checking seals for leaks.
   5. Provide encapsulated closures if upon visual inspection during construction it appears that the location for closure installation is or is likely to be subject to prolonged immersion in water and where specified by the SMU Infrastructure Design Engineer.
B. **OSP Fiber Splice Closures:** Provide high quality fiber splice closures. Install closures per manufacturer’s instructions. Closures shall be sized to accommodate the quantity of strands to be spliced with spare capacity to support a minimum of 100% additional splices in the future. Closures shall be outdoor or indoor rated (depending upon the use). Closures shall be either butt or in-line depending upon the application.

1. Splice closures located in maintenance holes/tunnels shall be supported on racks (at both ends) and shall be located to avoid blocking duct/tunnel access.
2. Cable shields/sheaths shall be connected together at all splices and termination points to assure a continuous metallic shield, and shall also be connected to the grounding conductor if located in a maintenance hole/tunnel. Electrically test the shield/sheath continuity. Connect each closure’s ground lug to the nearest TGB with a #6 AWG copper grounding conductor.
3. Connect each closure’s ground lug to the nearest TGB with a #6 AWG copper grounding conductor.
4. Fiber splices shall be fusion. Provide splice trays designed to mount within the closure to manage each splice. Protect each bare/stripped optical fiber strand with heat shrink or silicon adhesive to prevent exposure to moisture.
5. Closures shall be properly sealed and demonstrated watertight without encapsulant. Test seals after closure by pressurizing the closure and checking seals for leaks.
6. Provide encapsulated closures in the locations shown on the Drawings, or if upon visual inspection during construction it appears that the location for closure installation is or is likely to be subject to prolonged immersion in water and where specified by the SMU Infrastructure Design Engineer.

### 3.5 GROUNDING AND BONDING

A. All grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

B. Bond non-current carrying metal telecommunications equipment and materials to the nearest TGB or the nearest grounding conductor if in the outside plant.

C. Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

### 3.6 CABLE

A. **General (applicable to all cable types):**

1. Test fiber optic cable on the reel upon delivery to the job site, and again prior to installation. Permanently affix the test results to the reel. Do not install cables that fail the on-reel test. Replace any cables that fail the on-reel test at no additional expense to the Owner.
   a. Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.
2. Install cables in compliance with ANSI/TIA/EIA requirements, BICSI practices, and manufacturers recommendations. Adhere to the requirements detailed in the manufacturer’s recommendations and ANSI/TIA/EIA Standards relating to bending radius, pulling tension, other mechanical stresses, and pulling speed.
a. Monitor pulling tension on runs of 300 feet or longer. Acceptable monitoring devices are:
   1) Winch with a calibrated maximum tension
   2) Breakaway link (swivel)
   3) In-line tensionmeter

3. Carefully inspect the cables for sheath defects as the cables are paid off the reel. If defects are found during the pulling operation or if the cable on the reel binds, twists, or does not pay off freely, stop the pulling operation immediately and notify the manufacturer’s representative.

4. Do not splice cables unless specifically noted on the Contract Documents or instructed by the SMU Infrastructure Design Engineer.

5. For new duct bank, install cables in the lowest available conduit in a duct bank, working up as additional cables are installed. For existing duct banks, do not place cables in ducts other than those indicated on the Contract Documents or the SMU Infrastructure Design Engineer.

6. Where cables are pulled through maintenance holes or hand holes, select the same duct at both sides of maintenance holes or hand holes unless specifically noted on the Contract Documents or by the SMU Infrastructure Design Engineer. Avoid changes in duct selections, especially in elevations, to ensure that no damage occurs to the cable sheaths and that pulling tensions are kept as low as possible.

7. Maintain a sufficient length of cable in the tunnel systems and each maintenance hole or hand hole to properly rack the cable. Rack cables in the tunnel systems, maintenance holes and hand holes as soon as practicable, but within one week after cable installation. Route cables in the tunnel systems, maintenance holes and hand holes to avoid blocking duct/tunnel access.

8. When more than one cable is being installed in a conduit, pull all cables through the conduit simultaneously.

9. Where practicable, feed cables into ducts from the end of the duct that creates the least sidewall pressure on a bend during installation (i.e. feed cable from the end closest to the bend).

10. Use pulling compound or lubricant where necessary. Use lubricants that are compatible with the cable jacket material and in accordance with the manufacturer’s recommendations. Do not use soap-based lubricants. Where cable is pulled through a maintenance hole or handhole, re-lubricate the cable prior to feeding into the next duct. Immediately after cables have been installed, clean lubricant from exposed cables in maintenance holes and handholes and at termination points using dry rags.

11. Seal cable ends with end caps immediately after installation and until terminated in a termination enclosure to prevent moisture entry into the core of filled cables and to prevent damage during installation.

12. Provide a service loop in the BDF/MDF long enough to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum of 25 feet at each end. (Placing the service loops in the entry tunnel to conserve cable rack space will be acceptable.)

13. Comply with the NEC 50-ft rule when installing outdoor-rated cable (i.e. do not exceed 50 feet of exposed outdoor-rated cable length within a building).

14. Cable at the backboards:
   a. Lay and dress cables to allow future cabling to enter raceway (conduit or otherwise) without obstruction by maintaining a working distance from these openings.
b. Route cable as close as possible to the ceiling, floor or other corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

c. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Velcro together similarly routed and similar cables and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

15. Cable in the Telecommunications Rooms:
   a. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack with Velcro at regular intervals.

16. Building Entrances: Seal conduits (both in-use and spare) that enter the building from the outside plant to prevent intrusion of water, gases, and rodents.

B. Copper Cable:
   1. Provide copper cable in quantities and pair counts as shown on the Contract Documents.
      a. New Construction: Each building is required to have a campus feeder with a minimum pair count of 100. An increased pair count may apply on an individual basis that will be determined by the projected requirements for the building.
      b. Renovations/Remodels: Existing copper will be reused if possible. A new multi pair copper cable may be needed to bring the pair count up to 100. An increased pair count may apply on an individual basis that will be determined by the projected requirements for the building.
   2. Test copper cable on the reel upon delivery to the job site, prior to installation. Permanently affix test results to the reel. Do not install cables that fail. Replace failing cables at no additional expense to the Owner.
      a. Conform to the test procedures as outlined in the paragraph entitled TESTING at the end of this specification.
      b. Demonstrate that the test results are similar to the factory test results as shipped with the reel.
   3. Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.
   4. For shielded cable, bond the shield at both ends to the ground lug on the Building Entrance Protector.
   5. Copper splices are not acceptable except where specified by the SMU Infrastructure Design Engineer.
   6. Lighting protection for copper- If copper cables extend beyond the buildings cone of protection, the OIT approved lightning protection must be installed to ensure proper performance/protection. Lightning protection must be UTP category 6, 4 pair POE+ capable.

C. Fiber Cable:
   1. Provide fiber optic cable in quantities, strand counts, and types (singlemode, multimode, or composite multimode/singlemode (hybrid)), as shown on the Contract Documents. Provide cable with fan-out kits for both ends.
a. New Construction: Each main campus building is to be connected to the nearest MSH/ISH where a fusion splice will be required to connect the new fiber to the existing fiber which will completed the tie to Patterson Hall main switch room (MDF). Contractor shall install fiber containing a minimum of (24) strands of 62.5/125um multimode fiber and (48) strands of 8/125um singlemode fiber. In some cases in addition to the 62.5um multimode and 8um singlemode, a (12) strand 50/125um multimode fiber will be required. Please contact SMU OIT Infrastructure Design Engineer prior to ordering material and confirm MSH/ISH location. Campus Zone Map MSH/ISH (See map below)
b. Renovations/Remodels: Existing 62.5/125um multimode fiber will be reused if possible. A new 62.5um multimode fiber may be needed to bring the strand count up to 24. In addition to the 62.5um fiber, a new (12) strand 8/125um singlemode fiber shall be placed. In some cases in addition to the 62.5um multimode and 8um singlemode, a (12) strand 50/125um multimode fiber will be required.

2. Test fiber optic cable on the reel upon delivery to the job site, prior to installation. Permanently affix test results to the. Do not install cables that fail. Replace failing cables at no additional expense to the Owner.
   a. Conform to the test procedures as outlined in the paragraph entitled TESTING at the end of this specification.
   b. Demonstrate that the test results are similar to the factory test results as shipped with the reel.

3. Terminate all fiber strands within a fiber cable, unless specified in the Contract Documents or by the SMU Infrastructure Design Engineer.

4. For shielded cable, bond the shield at both ends to the TGB.

5. Fiber terminations and splices are to be fusion only.

3.7 LABELING AND ADMINISTRATION

A. General: Labeling and administration shall comply with TIA/EIA 606 and standard industry practices.

B. Color Coding: Apply industry standard color coding to cable termination fields. Always apply the same color to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color must be the actual color of the insert label on the termination equipment. Use the following color code:
   1. Orange: Identification of the telecommunication service (telephone company) demarcation point.
   2. Green: Identification of copper voice backbone that connects a building BDF to the Patterson Switch Room (MDF).
   3. White: Identification of fiber strands that connects a building BDF to the Patterson Switch Room (MDF).

C. Termination Equipment:
   1. Copper Building Entrance Protectors:
      a. Label each BEP on the outside with a minimum of 3/4 inch high lettering that clearly indicates the building at the opposite end of the cable. Label each BEP on the inside with details for each cable terminating in the panel: the cable identifier, the cable pair-count and the building at the opposite end of the cable.
         1) Outside of the BEP: Label shall be placed at the bottom right of the BEP or in the most visible location on the front of the BEP. (Example: A BEP used to terminate a 100-PR cable would have the following label on the outside of the BEP: “100pr Voice Feeder to Patterson”.)
         2) Inside of the BEP: New copper will fall into sequential order from the highest existing voice pair number. (Example: A BEP used to terminate a 100-PR cable would have the following label on the inside of the BEP on a green designation strip: “1551 - 1650”.)
   2. Fiber Patch Panels:
a. Outside the panel: Label fiber patch panels on the outside with a minimum of 3/4 inch high lettering that clearly indicates the building at the opposite end of each cable. In addition, label patch panels with a patch panel designation label as follows:

1) General: New fiber will fall into sequential order from the highest existing voice/data strand number. (Example: 12 Strand Voice 62.5 MM to Patterson (Strands 1551-1562)).

b. Inside the Panel:

1) General: Label patch panels with a single label which details the following information for cables terminating in the panel: The cable identifier, the building at the opposite end of the cable, the telecommunications room at the opposite end of the cable, the fiber type (62.5um multimode, 50um multimode, 8um singlemode, composite) and the strand counts.

3.8 TESTING

A. Provide test records on a form approved by the SMU Infrastructure Design Engineer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the cable identifier, outcome of test, indication of errors found, cable length, retest results. Provide test results to the SMU Infrastructure Design Engineer for review and acceptance within two weeks of Substantial Completion.

1. Provide test records for each cable within the system directly from the tester and submit in electronic form (on CDROM) to the SMU Infrastructure Design Engineer for review. Handwritten test results will not be accepted.

B. Test the OSP-SCS after installation for compliance to all applicable standards as follows:

1. Copper Backbone Distribution: Test copper cable on the reel upon delivery to the job site, again prior to installation, and again after installation.
   a. Test all cable pairs for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA 568-B Category 3 standards.
   b. Test entire channel, from termination block to termination block.
   c. Use a TIA/EIA Level III testing instrument, re-calibrated within the manufacturer’s recommended calibration period, with the most current software revision based upon the most current TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.
      1) Fluke DTX-1800 with latest software and hardware releases, or approved equal.

2. Fiber: Test fiber cable on the reel upon delivery to the job site, again prior to installation, and again after installation.
   a. Test all strands using a bi-directional end-to-end Optical Transmission Loss Test Instrument (OTDR) trace performed per ANSI/TIA/EIA 455-61.
      1) Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.
      2) Provide test measurements as follows:
         a) For Multimode Cable: Test at both 850 and 1300nm.
         b) For Singlemode Cable: Test at both 1310 and 1550nm.
   b. Test results shall conform to:
1) The criteria specified in ANSI/TIA/EIA-568-B
2) The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)

C. Identify cables and equipment that do not pass to the SMU Infrastructure Design Engineer. Determine the source of the non-compliance and replace or correct the cable or the connection materials, and retest the cable or connection materials at no additional expense to the Owner. Provide new test results to the SMU Infrastructure Design Engineer in the same manner as above.

1. In addition to the above, if it is determined that the cable is at fault, remove the damaged cable and replace it with a new cable. Cable “repairs” are not acceptable. The procedure for removing the cable shall be as follows:
   a. Prior to removal of damaged cable and installation of new cable:
      1) Inform the SMU Infrastructure Design Engineer of the schedule for the removal and installation.
      2) Test the new cable on the reel per paragraph B, above.
      3) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
      4) Provide test results to the SMU Infrastructure Design Engineer for approval by the Director of Telecommunications.
   b. Remove the damaged cable and provide new cable.
   c. After the removal of the damaged cable and installation of the new cable:
      1) Test the new cable per the paragraph titled TESTING.
      2) Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.
         a) If any of the cables requiring testing are in use, coordinate with the Infrastructure Design Engineer to schedule an outage opportunity during which the testing can be performed.
      3) Provide test results to the Infrastructure Design Engineer for approval by the Director of Telecommunications.
   d. If a cable which occupies the same innerduct or conduit (if not in innerduct) as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.
      1) Damaged cables which are replaced shall be subject to the testing procedures of the paragraph titled TESTING.

3.9 FOLLOW UP

For the first four weeks that the system is in full operation, provide technical assistance for trouble shooting, training, and problem solving by phone and (within 24 hours of notice) on site. Provide up to 40 hours of assistance (in addition to any warranty-related work), including phone, travel, and on site time during this period.
SECTION 16700
COMMUNICATIONS
INTRABUILDING CABLES

PART 1 – GENERAL

1.1 SUMMARY

A. This standard is intended for all “standard” installations at the Dallas and Plano campuses and is not intended to address special installations that are sometimes encountered and addressed on an individual basis. All new construction and major renovation require a custom bid specification to be provided by OIT based on information provided by Facilities.

B. Provide all materials and labor for the installation of an inside plant telecommunication system. This section includes Inside Plant Communications cabling, termination, and administration equipment and installation requirements for the specified Structured Cabling System (SCS – see definition below).

C. Products installed (but not furnished) under this section:
   1. Backboards and paint for backboards (installed by general contractor)
   2. Grounding conductor and grounding busbars (installed by electrical contractor)
   3. Electrical Outlets (installed by electrical contractor)

1.2 REFERENCES

Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

A. General
   1. National Electrical Code (NEC)
      b. Occupational Safety and Health Act (OSHA)

B. Communications:
   a. ANSI/TIA/EIA – 455: Fiber Optic Test Standards
   b. ANSI/TIA/EIA – 526: Optical Fiber Systems Test Procedures
   c. ANSI/TIA/EIA – 568-B: Commercial Building Telecommunications Cabling Standard
   d. ANSI/TIA/EIA – 569: Commercial Building Standard for Telecommunications Pathways and Spaces
   e. ANSI/TIA/EIA – 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   f. ANSI/TIA/EIA – 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
g. ANSI/TIA/EIA – TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
h. ANSI/TIA/EIA – TXB75: Additional Horizontal Cabling Practices for Open Offices
i. NECA/FOA 301-1997: Standard for Installing and Testing Fiber Optic Cables
j. NECA/BICSI 568-2001: Standard for Installing Commercial Building Telecommunications Systems
k. IEEE 802.3 (series); Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard
l. ISO/IEC IS 11801: Generic Cabling for Customer Premises
m. BICSI: BICSI Telecommunications Cabling Installation Manual
n. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)

1.3 DEFINITIONS

A. “SCS” shall mean Structured Cabling system. The SCS is defined as all required equipment and materials including (but not limited to) ANSI/TIA/EIA 568-B and ISO/IEC 118-1 compliant copper station cable (Category 3, Category 5e, Category 6, etc.) and fiber optic cable (multimode and singlemode), patch cables, stations and station connectors, termination blocks, patch panels, racks (such as EIA standard equipment racks, and vertical and horizontal cable management hardware), pathway/raceway materials (such as conduit, sleeves, J-hooks, D-rings, surface raceway, ladder rack, cable tray, etc.), and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

B. “TMGB” shall mean Telecommunications Main Grounding Busbars. There is typically one TMGB per building located in the main telecommunications room (MDF). This busbar is directly bonded to the electrical service ground. (Shall be installed by the electrical contractor.)

C. “TGB” shall mean Telecommunications Grounding Busbar. There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems. (Shall be installed by the electrical contractor.)

D. “UTP” shall mean Unshielded Twisted Pair cable.

E. “BDF” shall mean Building Distribution Frame. This is the room that houses the telecom equipment for a building and connects to Patterson Hall switch room (MDF).

F. “IDF” shall mean Intermediate Distribution Frame. Connects floors in a building to the building BDF.

G. “MDF” shall mean Main Distribution Frame. Located in Patterson Hall switch room.

H. “UTP” shall mean Unshielded Twisted Pair cable.

I. “Link” is defined as station cabling, work station outlet and patch panels/termination blocks.
J. “VCT” shall mean *Vinyl Ceramic Tile*.

**1.4 QUALITY ASSURANCE**

A. Contractor Qualifications
   1. SMU has three prequalified that must be given the opportunity to bid the cabling installations
      a. Able Communications
      b. (TBD)
      c. (TBD)
   2. The bidding contractor must be a local Systimax Solutions/ComScope Var.
   3. Contractor shall be trained and certified by the Manufacturers to install, test, and maintain the SCS and be certified by the SCS Manufacturers to provide the SCS Manufacturers Warranties (see PART 1 – WARRANTY).
      a. Systimax Solutions/ComScope (for copper).
      b. Systimax Solutions/ComScope (for fiber).
   4. Contractor’s employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS manufacturers. Training and certifications by employee type are required as shown below:
      a. Supervisors/Project Foremen: All (100%) shall be BICSI certified and Systimax Solutions/ComScope installations/testing certified.
      b. Test Technicians: All (100%) shall be trained/certified for installation and testing by Systimax Solutions/ComScope.
   5. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. project managers, clean-up crew, etc.) are not required to be manufacturer-trained and certified.
   6. Contractor’s employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:
      a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.
      b. Firestopping Technician: All (100%) shall be trained/certified for installation of the firestopping material.
   7. Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/subcontractor to the Contractor is not acceptable.) Contractor shall continue to employ a minimum of one RCDD throughout the duration of the project.
2.1 GENERAL

A. All Telecommunication rooms are preferred to be stacked one over another, where this is not possible a conduit pathway must be provided between each floor connection the closes IDF/BDF.

B. Placement of a telecommunication room shall be positioned to accommodate the 90 meter rule. The longest cable path originating from that room shall not exceed 90 meters.

C. BDF Specifications:
   1. Each building is installed with a BDF and serves as the point of entrance to the building for all copper and fiber cable coming from the main switch room in Patterson Hall (MDF).
   2. A minimum standard size of 10’ x 10’ of usable space is required. Usable space is defined as space not impacted by posts, columns, door swings and other structures that make space unusable.
      a. The BDF may require larger than standard space depending upon the switching equipment needed and density of population.
   3. All walls of a BDF are to be covered from floor to 8 foot AFF with ¾ inch fire retardant plywood and painted with a white or light gray fire retardant paint leaving (1) FRT stamp visible. The BDF shall be free of all “other” equipment boxes, conduits and controls such as fire alarm, security devices and controls, clock circuits and/or any other equipment not needed to the provision of voice and data communications.
   4. The BDF must have a minimum of (2) 20 amp, isolate ground, surge protected 4 plex outlets for every (100) data outlets within a building to provide power for the data equipment but not having less that (1) 4 plex.
   5. The BDF must be provided with lighting equivalent to a standard office environment.
   6. The BDF must be provided with cold air input and vented for circulation to support an ambient room temperature of 72 degrees Fahrenheit. (on average 2,160 watts of network equipment will be installed in each IDF)
      a. The actual unit for cooling this space is NOT to be located inside the BDF but ducted into the space to assure the safety of the electronic components from condensation leaks or drips.
   7. The BDF is to be free of water and plumbing.
   8. The BDF will have a non-water based fire suppression system. Dry chemical is not acceptable. FM200, CO2 or other owner approved suppression system will be used.
   9. The BDF flooring shall be static dissipate VCT.
   10. The BDF must have a 6awg copper ground bus tied into the building grounding grid and terminated in the BDF on a 6” x2” ground bus bar located as directed by the SMU Infrastructure Design Engineer. This grounding system is to be provided by the electrical contractor.
   11. Charter TV service is not to be placed in the same room with the voice and data network equipment.

D. IDF Specifications:
   1. Each floor of a building is normally installed with an IDF and serves as the wiring closet for the individual voice and data outlets on that floor only. These closets serve to
maintain the maximum 90 meter run length on data connections and help with providing redundancy to the system.

2. A minimum standard size of 4’ x 8’ of usable space is required, unless additional technologies outside of network equipment are scheduled to be placed in the IDF. If more than network equipment is expected to reside in the IDF, a minimum 10’ x 10” space shall be required. Usable space is defined as space not impacted by posts, columns, door swings and other structures that make a portion of that space unusable.
   a. IDF’s may require larger than standard space depending upon the switching equipment needed and density of population.

3. All walls of the IDF’s are to be covered from floor to 8 foot AFF with ¾ inch fire retardant plywood and painted with a white or light gray fire retardant paint leaving (1) FRT stamp visible. The IDF’s shall be free of all “other” equipment boxes, conduits and controls such as fire alarm, security devices and controls, clock circuits and/or any other equipment not needed to the provision of voice and data communications.

4. All IDF’s must have a minimum of (1) duplex AC receptacle for voice considerations. These circuits are to be 20 amp surge protected outlets.

5. All IDF’s must have a minimum of (2) 20 amp, isolated ground, surge protected 4 plex outlets for every (100) data outlets on a floor to provide power for the data equipment but not having less than (1) 4 plex.

6. All IDF’s must be provided with lighting equivalent to standard office environment.

7. All IDF’s must be provided with cold air input and be vented for circulation to support an ambient room temperature of 72 degrees Fahrenheit (on average 2,160 watts of network equipment will be installed in each IDF).
   a. The actual unit for cooling this space is NOT to be located inside the IDF’s but ducted into the space to assure the safety of the electronic components from condensation leaks or drips.

8. All IDF’s are to be free of water and plumbing.

9. IDF suppression systems are to be Dry Chemical.

10. IDF flooring shall be static dissipate VCT.

11. All IDF’s must have a 6awg copper ground bus tied into the building grounding grid and terminated in each IDF on a 6” x 2” ground bus bar located as directed by the SMU Infrastructure Design Engineer. This grounding system is to be provided by the electrical contractor.

12. Charter TV service is not to be placed in the same room with the voice and data networking equipment.

E. SCS components shall be manufactured by the manufacturers listed below. Components shall not be intermixed between different manufacturers unless the manufacturer of the SCS has listed in writing another manufacturer’s component as an “approved alternative product” and will warrant the “approved alternative product” as part of the SCS Manufacturer Warranty.

1. Bid only the following SCS Manufacturers and only bid manufacturers for which the Contractor is certified. The SCS Manufacturers shall be the following. Substitution is not acceptable:
   a. Systimax Solutions/ComScope, for copper-related products
   b. Systimax Solutions/ComScope, for fiber optic-related products

F. All copper-related components shall be part of the copper SCS project line and all fiber optic-related components shall be part of the fiber optic SCS project line – components shall not be intermixed between manufacturers’ SCS product lines. The SCS product lines shall
be engineered “end-to-end” – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

1. The Product Line shall be the following, per manufacturer. Substitution is not acceptable:
   a. For Copper Distribution: Systimax Solutions/ComScope
   b. For Fiber Distribution: Systimax Solutions/ComScope

G. Racks, rack cable distribution hardware, ladder rack, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this specification or in the Contract Documents.
   1. Rack/Distribution Equipment: Chatsworth Projects, Inc. (CPI)
   2. Wall-mount Racks: Chatsworth Products, Inc. (CPI)

H. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Contract Documents that is required for a fully operation, tested, certified and warranted system.

2.2 CONDUITS, PATHWAYS AND CABLE SUPPORTS

A. All conduits placed for SMU will be clean and free of moisture prior to acceptance by the SMU Infrastructure Design Engineer. A letter of certification is to be provided by the conduit installation contractor verifying the testing condition of the conduits.
   1. A minimum of (3) 4 inch entry conduit for outside cable plant should be placed in all new buildings; however there may be buildings that require more capacity based upon specific requirements or population density. The entrance capacity for all new buildings should be verified with the SMU Infrastructure Design Engineer.
   2. All buildings will provide for a riser chase or riser conduit which connects all IDF’s back to the BDF with a minimum of (2) 4 inch sleeves or conduit between each IDF with the lower floors typically having more sleeves or conduits than the upper floors. Sizing must be provided by the SMU Infrastructure Design Engineer once the outlet count for a floor is determined.
   3. Charter TV service will require a minimum of (1) 2 inch entry conduit and a 2 inch riser conduit from the entrance and termination point to a tap location on each floor.

B. Surface Raceway with fittings including (but not limited to) mounting clips and straps, couplings, internal and external elbows, cover clips, bushings, end fittings, outlet boxes and other incidental and miscellaneous hardware required for a complete Surface Raceway system.
   2. Surface Metal Raceway (SMR): Wiremold
   3. Sleeves: EMT conduit, with insulated throat bushings for each end.
   4. Backboards: ¾ inch A-A non-fire-retardant plywood backboards, void free, 2440-mm (cover all walls floor to 8 foot AFF) high unless otherwise noted.
   5. D-Rings: Metallic

C. Cable Supports (J-Hooks, Straps): Complete with incidental materials and assemblies required for mounting.

D. Ladder Rack: Complete with fittings including (but not limited to) splice kits, cable radius drop, radius bends, protective end caps, retaining posts, support brackets, foot kits, vertical wall brackets, wall angles, grounding hardware and other incidental and miscellaneous
hardware required for a complete ladder rack system. Ladder rack components shall be manufactured by the selected Rack/Distribution Equipment manufacturer.

1. Unless otherwise indicated, all ladder rack and incidental equipment color shall be: Black, 12”
2. Ladder rack: For CPI – Universal Cable Runway (Black, 12”)
3. Horizontal radius bends: For CPI – Cable Runway E-Bend (Black 12”)
4. Cable Retaining Posts: For CPI – 10596-108
5. Radius Drops: For CPI – (Black, 12”)
6. Ladder rack/cable runway grounding kits: For CPI – 12061-001

E. Pull Strings: Plastic or nylon with a minimum test rating of 00lbs.

2.3 EQUIPMENT RACKS

A. Unless otherwise noted, equipment racks/enclosures and incidental equipment color shall be: Black aluminum.
B. Unless otherwise indicated, equipment rack/wall-mounted brackets and incidental material and equipment shall be provided by the selected Rack/Distribution Equipment manufacturer.
C. Freestanding Equipment Racks: EIA-standard 7-foot high by 19-inch racks with universal alternating hole pattern, complete with top angles, self-supporting bases, and mounting holes on both sides of the rails.
   1. Racks: for CPI – Standard Rack
   2. Wide (12 inches) cable channels for vertical cable management: For CPI – Double sided.

2.4 STATIONS

Voice and data cabling cannot share conduits with ANY other kind of cabling (i.e. coax, audio video or any other low voltage cabling.

A. A minimum of 2 data (category 6) are required for any usable space. Install enough cable slack to reach the furthest point in the usable space. All slack shall be safely secured in service loop above nearest suspended ceiling.
B. A minimum of (2) data (category 6) is required for each projector location called out on the construction documents.
C. A minimum of (2) data (category 6) is required for each TV location called out on the construction documents.
D. A minimum of (2) data per wireless access point
E. A minimum of (1) data for CCTV
F. A minimum of (5) data for fire panel
G. A minimum of (1) data for irrigation controller
H. A minimum of (1) data in CCure panel per (16) doors

2.5 WIRELESS LOCATIONS

A. A soft copy of the construction documents must be provided to the SMU OIT department for review. A design will be created and submitted to Facilities.
B. A 2-gang device box is required in all solid and open ceiling wireless locations called out on the construction documents with a 3/4” conduit stubbing into the nearest accessible ceiling.
C. Exterior wireless locations are to be planned for any new construction or renovation where there is a north, south, east or west face of the structure. A 1” sleeve is to be provided stubbing into the nearest accessible ceiling at the location specified by the SMU OIT department on the construction documents.

1. It is the electrical low voltage contractors responsibility to mount the antenna arm, antenna and route the tail into the nearest accessible ceiling.

D. Outdoor wireless bollards. Low voltage contractor shall install all electronic components inside the SMU provided outdoor bollard.

Wireless Pad Specifications:

![Outdoor Wireless Pad Top View](image)

![Pad Dimensions with Hook Bolt Spacing](image)
Outdoor Wireless Pad
Elevation View

Pad Depth
Pad Height above grade
Bolt Height above pad

1/2" galvanized bolts w/nuts (7" above pad)

Level surface w/ flat smooth surface

---

Level surface with Flat Smooth finish

Conduit and ground rod height from pad.
(1) conduit for data
(1) conduit for power

Wifi bollards pads must have a dedicated circuit for power. It is allowable to share (1) dedicated circuit across (3) wifi bollard pads.
Wireless bollard specifications must have:

1) (1) conduit for power
2) (1) conduit for data (must maintain 8x cable diameter bend radius on conduit path)
3) ½ inch galvanized bolts must be minimum 7” into concrete pad
4) (1) Dedicated power outlet per bollard pad. It is acceptable to share (1) dedicated circuit up to (3) wireless bollard pads
5) Pad must be level and have a smooth surface and contact SMU Infrastructure Design Engineer upon completion to sign off on finished pad.

2.6 CABLE
A. General: All terminations shall follow the 568B wiring standard. Station runs shall not exceed 90 meters. Splices of any kind will not be accepted. Cables shall be manufactured by the selected SCS Manufacturer.

B. Copper Cable:
1. For Horizontal Voice & Data Distribution: Category 6, 4-pair, UTP, 23-AWG, solid copper conductors, blue, plenum and shall meet or exceed the category 6 wiring standard requirements as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801:
2. Termination of data cables shall be placed on commscope modular patch panels.
   a. For Systimax Solutions/ComScope:
3. For Backbone Distribution: (A minimum of (25) pair Cat3 riser will be installed from OSP Circa protector to the BDF & to each IDF)
   a. Category 3 (voice) risers shall be 24-AWG, unshielded, solid conductor, riser rated, plenum cable if required by code and approved by the SMU Infrastructure Design Engineer.

   1) A standard of 25 pair riser from the BDF to each IDF shall terminate on a (24) port patch panel, leaving the last pair unterminated. Each pair will only utilize. Contact SMU Infrastructure Design Engineer for rack elevations.
      a) Systimax Solutions/ComScope (or approved equal)
   2) Systimax Solutions/ComScope (or approved equal)

C. Fiber Cable
1. For Backbone Distribution: A minimum of (12) strands of 50um fiber riser will be installed from the BDF to each IDF
2. 50um Multimode risers: shall be (12) strands, risers rated or plenum rated cable if required by code and approved by the SMU Infrastructure Design Engineer. Each 50um strand will terminate in LC connectors in an approved LIU or rack mounted fiber shelf. Cable shall be manufactured by the selected SCS manufacturer:
   a. For Systimax Solutions/ComScope
   b. 

2.7 LABELING AND ADMINISTRATION

A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

2.8 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.
B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.
C. All work shall comply with the standards, references and codes listed in PART 1 – REFERENCES above. Where questions arise regarding which standards, references or codes apply, the more stringent shall prevail.
D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.
E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.
F. Remove surplus material and debris from the job site and dispose of legally.

2.9 DEMOLITION

A. Demolish existing telecommunications equipment, cable, materials, and incidentals no longer in use after installation of and cutover to the new SCS.
B. Remove all materials demolished by the Contractor from the site and dispose of properly and legally.

3.0 RACE WAY

A. Surface Raceway: Provide for all surface mounted stations as shown in the Contract Documents.
   1. Size surface raceway according to the quantity of cable to be routed through it according to ANSI/TIA/EIA 569 cable capacity standards, plus an additional 100% for future expansion. Size fittings/bends to accommodation Category 3/5e/6 and fiber optic bend radii as specified in ANSI/TIA/EIA 569.
   2. White is the only accepted color of raceway that is to be mounted on but do not paint surface raceway. Surface raceway shall be:
      a. Installed per Article 352 of the NEC. Surface raceway shall be installed as mechanically and electrically continuous and bonded in accordance with NEC and ANSI/TIA/EIA 607 codes and standards.
      b. Installed according to ANSI/TIA/EIA standards for fiber optic and Category 3/5e/6 bend radii. Bend points shall have a minimum two inch radius control.
      c. Securely supported using screws or other anchor-type devices (tape or glue is not an acceptable support medium) at intervals not exceeding 5 feet and with no less than two supports per straight raceway section. Surface raceway shall be supported in accordance with the manufacturer’s installation requirements.
      d. Completely installed including insulating bushings and inserts where required by manufacturer’s installation requirements.
      e. Installed parallel and perpendicular to surfaces or exposed structural members, and following surface contours where possible.
      f. Close any unused raceway openings.
B. Horizontal Sleeves (user office spaces and residence rooms): Provide sleeves where required for cable pass-thru through building structures and/or fire rated barriers. Provide core drilling where required for sleeve installation. Seal (and if a fire rated barrier, firestop) between sleeve and building structure and/or barrier. Size sleeves:
   1. As noted in the Contract Documents
2. Where not noted, size sleeves a minimum of 2 inches in diameter or by the type and quantity of cable to be routed through the sleeve per ANSI/TIA/EIA 569 cable capacity standards plus an additional 100% for Future expansion – whichever is greater.

C. Cable Supports (J-Hooks, Straps): Provide cable supports for routing cable in non-exposed open access environments. Cable supports may be affixed to wall/ceiling structures or other supports, but not attached to a ceiling support system. Mount cable supports at 4 foot intervals unless otherwise specified. Do not use cable supports for more cables than they were designed to support. Provide multiple cable supports where the total cable count exceeds the maximum cable count for which the support was designed. Size according to the type and quantity of cable to be routed through the ring per ANSI/TIA/EIA 569 cable capacity standards, plus an additional 50% for future expansion.

D. Ladder Rack: Install ladder rack per manufacturer’s instructions with flat (rung) side up. Provide ladder rack to affix tops of racks to walls, to route cable from walls to racks within telecommunications rooms. Cut ends of ladder rack square. Ream cut ends to remove burrs and sharp edges. Cap cut ends with manufacturer’s recommended caps. Mount retaining posts as required. Provide Cable Radius Drops wherever cable is to drop from one section of ladder rack to another lower section of ladder rack. Provide 90-degree horizontal radius bends for each 90-degree change in direction of ladder rack angle. Provide Cable Runway Grounding kits across ladder rack splices and where ladder racks end at or are connected to racks/cabinets.

E. Pull Strings: Provide a pull string in existing conduits that are to remain vacant after existing cable is demolished and in existing and new conduits that have new cable installed under this project.

3.1 FIRESTOPPING

A. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

B. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.

1. Provide firestopping material for through and membrane penetrations of fire rated barriers.

2. Install firestops in strict accordance with manufacturer’s detailed installation procedures.

3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable code and standards referenced in PART 1 – REFERENCES. Apply sealing material in a manner acceptable to the local fire and building authorities.

4. For demolition work, apply firestopping to open penetrations in fire rated barriers where cable is removed. Apply firestopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.

5. Firestopping material used to seal open penetrations through which cable passes shall be reusable/re-enterable.

3.2 GROUNDING AND BONDING

A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed.
in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Provide a minimum of one 6” x 2” wall-mountable telecommunications ground bus bar per telecommunications room. (Shall be installed by the electrical contractor.)

2. Grounding conductor shall be installed to bond all non-current carrying metal telecommunications equipment and materials to the nearest TMGB or TGB.
   a. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.
   b. Provide ladder rack grounding kits to bond each section of ladder rack and bond ladder rack to racks where ladder racks are connected.

3.3 PATCH PANELS

A. Provide patch panels and horizontal wire management according to the SMU bid specification provided by the SMU OIT department.

B. Fiber: Size and install rack-mountable patch panels as shown in the SMU bid specification. Use fiber patch panels to terminate multimode and/or singlemode fiber backbone cables.
   1. Horizontal Wire Management: provide horizontal wire management as shown in the SMU bid specification.

C. Standard rack elevations (contact SMU Infrastructure Design Engineer for rack elevations prior to installation):
3.4 STATIONS

A. Faceplates: Provide faceplates for stations in the locations and gang counts shown in the SMU Bid Specification. Faceplates shall completely conceal outlet boxes, reducer plates, etc. Faceplates shall provide a snug and sure fit for connectors – loose connectors are not acceptable.

B. Faceplate Mounting Brackets: Provide faceplate mounting brackets as required for flush mounted communications outlets.

C. Surface Device Boxes: Provide surface mount device boxes as required for surface mounted communications outlets.

3.5 CABLE

A. General (applicable to all cable types): Provide plenum (CMP, OFNP) rated cable for all SMU buildings. Cabling shall bear plenum markings.

1. For Horizontal Distribution: Provide station cable in types, sizes, and quantities as defined by the Symbol Schedule and as shown on the contracts Documents. Install cable between the station and its associated telecommunications room. Provide on
cable per each connector at each station. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.
2. For Intrabuilding Backbone Distribution: Provide intrabuilding backbone cable in types, sizes, and quantities as shown in the SMU bid specification. Install intrabuilding backbone cables between telecommunications rooms within the same building. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.
3. Install cable in compliance with ANSI/TIA/EIA and ISO/IEC 11801 requirements and BICSI TCIM practices.
4. Install cable in a continuous (non-spliced) manner unless otherwise indicated by the SMU Infrastructure Design Engineer.
5. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.
6. Tie or clamp cabling. Attaching cables to pipes, electrical conduit, mechanical items, exiting cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable. Install tie-wraps in conformance with the SCS manufacturer’s installation recommendations. Do not over-tighten tie wraps or cause cross-sectional deformation of cabling. Install Velcro in the telecommunications rooms, tie wraps will not be accepted.
7. Cable in the telecommunications rooms: For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals with Velcro straps.
8. Cable terminating on patch panels located on racks: Route cables in telecommunications rooms to patch panels on racks by routing across ladder rack across top of rack and then down vertical wire managers to patch panel.

B. Copper Cable: Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.

1. For horizontal distribution: Provide station cable in the locations shown on the Contract Documents. Provide service loops with a minimum length of 12 inches in outlet boxes and no less than 10 feet at the work station and in the BDF/IDF’s.
   a. Route station cable that is exposed (not in conduit) to comply with ANSI/TIA/EIA-569 requirements for avoiding potential EMI sources and as follows:
      1) 48 inches from motors or transformers
      2) 12 inches from conduit and cables used for electrical power distribution
      3) 6 inches from fluorescent lighting

2. For intrabuilding backbone distribution: Install intrabuilding backbone cable in the locations shown on the Contract Documents. Provide a service loop long enough in the BDF/IDF’s to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum length of 10 feet at each end.
   a. For shielded cable, bond both ends of the metallic shield (or metallic strength member) to the nearest earth ground.

C. Fiber Cable: Terminate all fiber strands within a fiber cable. The installation of “dark fiber” is not acceptable unless specified by the SMU Infrastructure Design Engineer.

1. For Intrabuilding Backbone Distribution:
   a. For shielded cable, bond both ends of the metallic shield (or metallic strength member) to the nearest earth ground.
   b. Provide a service loop long enough in the BDF/IDF’s to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum of 10 feet at each end.
c. The service slack stored inside the fiber patch panel cabinets shall be a minimum of 3 m (10 feet).

3.6 LABELING AND ADMINISTRATION

A. General: All campus riser or tie cable will be labeled with “To/From” information and unique cable number as specified by the SMU Infrastructure Design Engineer.

B. Color Coding: Apply industry standard color coding to cable termination fields. Always apply the same color at both ends of any given cable. Cross-connections are generally made between termination fields of different colors. Use the following color code:
   1. Orange: Identification of the telecommunication service (telephone company) demarcation point.
   2. Green: Identification of outside plant category 3 on 110 hardware.
   4. Blue: Identification of the horizontal distribution (data station) cables on 110 hardware. A blue color coding is only required at the telecommunications room end of the cable, not at the station end of the cable.
   5. Yellow: Identification of data copper riser cable on 110 hardware.
   6. Red: Identification of the horizontal distribution (voice station) cables on 110 hardware. A red color coding is only required at the telecommunications room end of the cable, not at the station end of the cable.

C. Telecommunications Rooms: Affix a permanent label to the exterior wall/door of each telecommunication room. Use the telecommunication room name shown on the Contract Documents.

D. Grounding/Bonding Conductors: Label bonding conductors: “WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!”

END OF SECTION 16700
Southern Methodist University
Irrigation Specification

Construction: Once the irrigation design has been approved and the contract has been awarded, the contractor installing the system has accepted full responsibility for the surrounding irrigation and landscape. This means that if the irrigation system is disturbed or damaged by the contractor, the contractor will repair that system at their expense. In some cases, the system will have to be put above ground during construction and reinstalled, but it will be operational during construction to keep plant material alive.

Irrigation Plan: Facilities has the final approval of the irrigation design. The design firm preparing the drawing needs to set up a meeting with Facilities to make sure that everything involved is included before any design work is started.

Controller: Rain Bird ESP-SAT-LW Size to job
Controller will be labeled with correct zoning order laminated and attached to inside of door with Velcro
Inter-matic secondary surge arrestor AG -2401 installed in ½” x ½” x ½” tee ell bee connector screwed onto transformer
RBDS-SE-M-ET Ethernet Box or RBDS-S-M-W-K Wireless Ethernet Box
PT-322 Flow Monitor for Flow sensor installed inside Controller
For controllers mounted outside, the contractor also needs to install Model 570/580 100 Base-T (Cat-5) surge protector

NOTE: The RBDS Ethernet boxes will need to be programmed before they will Work with our system. They can be given to FS and the Senior Irrigator will program it or have it programmed.
The Rain Bird SAT controller and Ethernet Device will need to be ordered early because they are made when ordered and are not a stock item

Valves: Rain Bird PGA Series Electric (Normally Closed)
Master Valve sized to mainline (Normally Closed)
T-Type Flow Sensor (Data Industrial) Sized to mainline with 10 X Diameter of pipe size in front of sensor and 5 X Diameter of pipe Size down stream of flow sensor with no fittings in these areas
22g. 6 pair ICKY-PIC PE-89 wire ran from flow sensor to controller With no splices
Connection at flow meter will be made with a Super Service seal
All valves and flow meter will be installed in a 10” Ametek valve box With green lid unless otherwise noted on plan
All valve boxes to be installed in turf and groundcovers to allow for proper maintenance
Do not install valves or drip indicator heads in shrubs.
The box that contains the drip air relief valve should be 10”, no less.

Heads: Rain Bird 1800 PRS series pop up in 4”, 6” and 12” using plastic MPR
Nozzles
Rain Bird SBE fitting will be used on all pop ups and ¾”
5004 Plus PRS
Falow Rotors will be installed using Lasco O-ring Swing Joints
Riser will be Schedule 80 sized to give 100% coverage of Plant Material
Risers will be added to base of 12” popup behind shrubs (back of hedge) for 100% coverage.

Zones: The irrigation design will separate all plant material
Grass with Grass
Shrubs with Shrubs
Color Beds with Color Beds
Groundcover with groundcover

Trees: All trees will be irrigated by bubbler type heads and installed as their own zone.
Install one 1GPM bubbler per 50 gallons of tree root ball.

DCA: Febco or Watts installed in a Jumbo Ametek Box with 3” of clearance on the bottom
with 3” of Pea gravel in bottom of box.
Install QCV between DCA and Master Valve with the QCV inside the
DCA box or a 10” round box.

Wire: Will be 14g Red for all irrigation zones with a White 14g Common
Master Valve will have a 14g wire of a different color
Splices will be made with a King One Step Tan or larger Connector
With no more than two splices in a valve wire run
PE-89 ICKY-PIC will have no splices from flow meter to controller

Piping: Sleeves will be two 4” pipes side by side
System piping will be done with Class 200 PVC sized to section flow
With no ½” pipe installed at all. ¾” pipe will be the smallest pipe installed

Substitutions:
Specific reference to manufacturers’ names and products specified in this
Section are used as standards, but this implies no right to substitute other
Materials or methods without written approval of the SMU representative.

Ornamental Grasses:
All large plantings of ornamental grasses should be irrigated with Rainbird 5012
high-pop rotor.

Irrigation Drawings:
Contractor shall furnish Record Drawings of the complete irrigation system in
accordance with the general and special conditions. Actual location of valves and
quick couplers and all irrigation and drainage piping shall be shown on the prints by
dimensions from easily identified permanent features, such as buildings, curbs,
fences, walks or property lines. The drawings shall be to scale and all indications
shall be neat.
Contractor will provide a detailed description of the station watering zone. For
example:

Station 1 – Ground cover northeast corner of building
Station 2 – Shrubs east side of building  
Station 3 – Lawn south side of building parkway  

This needs to be posted inside the controller door.  
At the time of walk-thru, the contractor will supply SMU with a copy of the detailed station watering zone and material invoices from their supplier showing all materials ordered for the job.  

Existing Irrigation system:  
All existing irrigation circuits shall be kept in operation at all times. If the existing system is damaged by this construction, the contractor will be responsible for immediate repair of such damage. After each repair, all heads on the repaired zone shall be removed and cleared of all dirt and foreign matter.

Layout:  
Full and complete coverage is required. Contractor shall make any necessary minor adjustments to lay out required to achieve 100% coverage of irrigated areas at no additional cost to owner. In shrub beds, a minimum of 12” will be left open (unplanted) between shrub and irrigation heads at the front side of the bed.

Excavating and Trenching:  
Trenching will be done only outside the drip line of all trees. When a line has to go within the drip line of any tree, it needs to be installed by boring under the tree or by air spading. (Within 25 feet of the trunk)

In addition to the above specifications, the irrigation and landscape area surrounding any project, will be included in the funding for the project. In the past, the grounds department has been responsible for the reconnection and repairs to existing or damaged irrigation and landscaping associated with the ongoing project. We would like for the projects to look beyond the “fence” and consider the impact on the surrounding environment.

Non Potable Irrigation Installation on Campus (GRAY WATER SYSTEMS)  
All 1800 PRS series spray heads will have the 1800 NP Cover installed on them.  
Any riser installed will need a purple shrub adapter Part # PA-85-NP.  
Valves will be the Rain Bird PESB sized to zone and will have the NP Handle.  
Valve boxes will be Ametek 10” round boxes with the NP cover.  
Any rectangle boxes installed will also have the NP cover.  
All piping will be done with manufactured purple PVC class 200 sized from ¾” and up.  
No ½” pipe will be used.

Material List:  
Contractor will supply Southern Methodist University with a list of all irrigation materials installed at first walk-through of system and back flow test report.

As-Builts:  
To allow for proper maintenance of the irrigation system all project as-builts will be shared with FS’s Sr. Irrigator at time of project completion.
Area 4
Area 6
East Area 1
East Area 2
1 CAST STONE BENCH

CAST STONE BENCH TOP

CAST STONE BENCH LEG (GELODIA) - FABRICATE 8 1/2 TREADS AT 24 IN SPACING, ATTACH TO CONCRETE SUBSLAB WITH STAINLESS STEEL THREADING. RADIUS SET IN POST AS SHOWN. BUILD TO REVIEW AND APPROVE A COLOR AND TEXTURE SAMPLE OF THE CAST STONE PRIOR TO THE FABRICATION OF THE BENCHES. SAMPLE SIZE TO BE 2'X2' MINIMUM.

PLAN

CAST STONE BENCH TOP

CAST STONE BENCH LEG - FABRICATE 8 1/2 TREADS AT 24 IN SPACING, ATTACH TO CONCRETE SUBSLAB WITH STAINLESS STEEL THREADING. RADIUS SET IN POST AS SHOWN. STAINLESS STEEL, THREADED M4X3/4 DIA 1/4" DIAMETER 12" LONG, PROVIDE 2 PER LEG (TYPICAL).

CONCRETE PAVERS

BAND SETTING BED

REINFORCED CONCRETE SUBSLAB

COMPACTED SUBGRADE (TYPICAL UNDER ALL PAVERS)

2 CAST STONE BENCH

LEG SECTION

RADIUS EDGE

RISE ALONG CENTERLINE OF BENCH

NOTE PANEL SECTION 4" DEEP - TYPICAL BOTH SIDES OF LEG

LEVEL, RISE EDGE

CAST STONE BENCH LEG

CAST STONE BENCH BASE

LEVEL, 6" DEEP PER LEG

SIDE ELEVATION

CAST STONE BENCH LEG

CAST STONE BENCH BASE

LEVEL

NOTE:

MATCHING EXISTING BRICK MANHATTAN BLOCK AND BRICK BENCH AS MANUFACTURED BY:

ADVANCED CAST STONE

85 HAWK ST

FORT WORTH, TX 76106-1029

BETTYS CAST COES

COLOR: CLASSIC WHITE

FINISH: SMOOTH
Standard Flat Lid Specification:

Keystone Ridge Designs
Product Number R-FL, 32-gallon

Dimensions:
Outside Diameter – 23-5/8”
Height – 1-1/2”
Opening – 12”

Material: 16 gauge cold rolled steel
Powder Coat: Keyshield Powder Coating Process — **Color to be Fossil**
Sandblasted
Corrosion-inhibiting phosphate
Zinc-rich epoxy powder primer
Colored polyester powder-coating (Fossil)
Powder coating applied to a 7-15 mil thickness
SMU Cast Stone Trash Can Liner

Purchase at www.globalindustrial.com

Rigid Plastic Liner - Round 36 Gal. Receptacles

Sold by: globalindustrial.com
Availability: ✔️ Usually ships in 19 to 22 days
Stock No: WBB455525

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Weight: 2lbs.
Dimensions: Outside Diameter, 11-1/8” Height, 3-7/8”
2" x 2" TAB W/ SLOTTED HOLE TO RECEIVE STAPLE
1 1/2" PIPE BELOW
UPPER BASE PLATE
3/8" THICK

2" x 2" TAB W/ WELDED STAPLE FOR PADLOCK
HOLE THROUGH PLATE TO RECEIVE 1 1/2" PIPE
2" PIPE BELOW
(4) #3 REBAR BELOW
LOWER BASE PLATE
3/8" THICK

(4) #3 REBAR
2" PIPE WELDED TO LOWER BASE PLATE; RECEIVES 1 1/2" PIPE WELDED TO UPPER BASE PLATE

ASSEMBLED BASE PLATES
LOCK BOX LID REMOVED
SAN JOSE BOLLARD (LOCKABLE)

NOTES:
1. BOLLARD BODY: 1 PIECE, CAST ALUMINUM, 1/2" TYP. THICKNESS
2. ALL BASE PARTS ARE STEEL

URBAN ACCESSORIES
465 East 15th Street
Tacoma, WA 98421
Ph (253) 572-1112
Fax (253) 572-1119

SAN JOSE BOLLARD
PROJECT:
PROJECT:
DRAWN BY: A.S.
DATE: 3/1/98
SCALE: N13
MATERIAL: CAST ALUMINUM/ STEEL
REV.: C. DIAMOND
DATE: 1/10/01
bollard covers, post sleeves, post covers, traffic bollards

Post Guard brightens your traffic posts and bollards with good-looking protective sleeves. Our High Density Polyethylene (HDPE) post covers fit easily and securely over existing posts to improve property appearance, visibility and safety. As the US-based manufacturer of our Post Guard products, we invite you to become a part of our growing family of satisfied customers.

While bollards direct traffic and protect areas from vehicle damage, bollard posts must be repainted frequently. Our bollard covers (also referred to as post sleeves or post covers) slip over steel pipes, steel poles and cement bollards to improve appearance and eliminate repainting and maintenance costs.

Post Guard customers are impressed by our quality products, price and dedication to personal service and customer satisfaction. It's easy to see why Post Guard bollard covers are at thousands of sites.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick Payback</td>
<td>Eliminates constant repair</td>
</tr>
<tr>
<td>High Quality Plastic</td>
<td>Designed for all weather conditions</td>
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<tr>
<td>Reflective Striping</td>
<td>Increase visibility &amp; safety</td>
</tr>
<tr>
<td>Easily Installed</td>
<td>Slides on existing post</td>
</tr>
<tr>
<td>Fade Resistant</td>
<td>Ultraviolet stable for 5 years</td>
</tr>
<tr>
<td>Great Looking</td>
<td>Improves property appeal</td>
</tr>
<tr>
<td>Secure</td>
<td>Locks in place to help prevent theft</td>
</tr>
<tr>
<td>Fast Shipments</td>
<td>Typically same or next day</td>
</tr>
</tbody>
</table>

http://www.postguard.com/

12/10/2008
SECTION 02874
BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes:
   1. Bicycle parking racks (heavy duty winder), black.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of bicycle parking racks similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing bicycle parking racks similar to those required for this project and with a record of successful in-service performance.

C. Source Limitations: Obtain each color, finish, shape and type of bicycle parking rack from a single source with resources to provide components of consistent quality in appearance and physical properties.

D. Product Options: Drawings indicate size, shape and dimensional requirements of bicycle parking racks and are based on the specific system indicated.

1.3 REFERENCES

A. Steel Pipe:
   1. ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   2. ASTM A 312 Standard Specification for Seamless and Welded Stainless Steel Pipes

B. Hot-Dipped Galvanized Finish:

1.4 SUBMITTALS

A. Product Data: Include physical characteristics such as shape, dimensions, bicycle parking capacity and finish for each bicycle parking rack.

B. Shop Drawings: Show installation details for each bicycle parking rack.
C. Samples for Verification: For the following bicycle parking rack/s, showing; (1) the color of the powder coat finish. Prepare 2 inch by 3.5-inch (50.8 mm by 87.5mm) powder coat samples (or larger) from the same material to be used to finish the product, (2) the actual galvanized finish. Prepare a sample piece of sufficient size to judge its quality, (3) Stainless steel. Submit a sample piece for review.

D. Maintenance Data: For each bicycle parking rack.
   1. Include recommended methods for repairing damage to the powder coat finish.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store bicycle parking racks in original undamaged packages and containers until ready for installation.

B. Handle powder coated bicycle parking racks with sufficient care to prevent any scratches or damage to the finish.

1.6 WARRANTY

A. Bicycle parking racks are to carry a one year manufacturer’s limited warranty against defects in materials and workmanship. The one year warranty period begins the date the product is shipped from the manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide bicycle parking racks manufactured by Madrax, Inc.

2.2 MATERIALS

A. Powder Coating: Triglycidyl isocyanurate (TGIC) powder, a polyester coating.
   1. All bike racks must be black.

2.3 BICYCLE PARKING RACKS

A. Heavy Duty Winder: The bicycle parking rack shall be the HW238-__-__-_ <insert bike capacity, installation method and finish selection> bicycle parking rack as manufactured by Madrax, Inc. Hot-dipped galvanized and powder coated options: Rack shall be constructed of ASTM A53, 2” Schedule 40 steel pipe (2-3/8” O.D. x 0.154” thick wall (60.3mm x 3.9mm)) or better. Stainless steel option: Rack shall be constructed of ASTM A312, 2” Schedule 40, TP 304 stainless steel pipe (2-3/8” O.D. x 0.154” thick wall (60.3mm x 3.9mm)) polished to a satin #4 finish. Rack shall be a minimum of 42” (1066.8mm) high to provide proper clearance for parked bicycles.

PART 3 - EXECUTION
3.1 INSTALLATION

A. Handle and install bicycle parking racks in accordance with manufacturer’s recommendations and installation instructions.

B. Set bicycle parking racks secured to construction, level and true to line, in correct relationship to adjacent materials.

C. Bike racks must be an in ground mount only. No surface flange mounts or surface gusset mounts.

END OF SECTION 02874
**MADRAX DIVISION**
TRILAX INC.
2210 PINEHURST DRIVE
NORTHCLIFFE, MI 48070
P(313) 440-7031, F(313) 815-9440, F(888) 815-7623
WWW.MADRAX.COM, E-MAIL SALES@MADRAX.COM

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**Product: HR2039-1-9055.90**
**Description:** Heavy Duty Parking Bike Rack
**Date:** 5/5/2019
**BID: TLS**

**NOTES:**
1. INSTALL BIKE RACKS ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
2. CONSULTANT TO SELECT CONCRETE, SEE MANUFACTURER'S SPECIFICATIONS.
3. SEE SITE PLAN FOR LOCATION OR CONSULT OWNER.
4. SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

---

**CHECK DESIGNED MOUNT C1**

---

**SURFACE OR IN GROUND MOUNT**

---

**GRID MOUNT (10)**

---

**5/8 ANCHOR ROD**
**THREADED HOLE (INJECTED BY MADRAX)**
**CONCRETE**
**GRAVEL**
**NATIVE SOIL**

---

**86'10" x 1'**
**9'20"**
**51'10"
**42" x 40"**
**85'34" x 1**

---

**ELEVATION VIEW**
**7 LOOP - 9 BIKE CAPACITY**

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** Last Revision June 2019 **

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**Site Planning and Utilization**
**B-3M - 5**
Jack Arch Information

Old Virginia Brick manufacturers custom arches from architects’ full size details. Full scale drawings are provided once the order is entered *. All orders for jack Arches must be accompanied by a completed Arch Form with the following information

1. Type of Arch
2. Brick Type, color, and size
3. Dimension of Masonry opening
4. Height in Courses
5. Skew Angle (68° standard)
6. Mortar Joint Thickness (3/8” standard- Molded brick can be ground to as little as 1/8” joint upon request)
7. Soffit Depth, if applicable

Note: Molded Jack Arches are hand-ground to assure accurate size and exact dimensional tolerances.

*If a cancellation or modification of the arch order occurs, the cost of the drawings will be billed.

Suggested Heights for Jack Arches

Increased height will require slugs

<table>
<thead>
<tr>
<th>Courses</th>
<th>Modular</th>
<th>Engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Courses</td>
<td>7 1/2”</td>
<td>9 1/8”</td>
</tr>
<tr>
<td>4 Courses</td>
<td>10 5/16”</td>
<td>12 5/16”</td>
</tr>
<tr>
<td>5 Courses</td>
<td>12 7/8”</td>
<td>15 1/2”</td>
</tr>
<tr>
<td>Max. Brick Width</td>
<td>2 1/8”</td>
<td>2 5/8”</td>
</tr>
</tbody>
</table>
SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.1 CONDITIONS

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings, or specified herein.

C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.

D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

E. Installer of electronically controlled doors and attendant controllers must be a certified installer of CCURE 9000 (vendor: Software House).

F. The ongoing security system integration agreement between the Owner and Siemens, a Class B Contractor, stipulates that portions of this scope of work be performed and/or verified compliant by Siemens in order to preserve the operational integrity of disparate subsystems, assure adherence to Owners implementation philosophy, and preserve system warranty. Responding contractor elect shall coordinate with Owner’s representative prior to bidding. Siemens contact: James Holden 972-621-5727 Email: james.holden@siemens.com

1.2 WORK INCLUDED

A. This section includes the following:
   1. Furnish door hardware (for hollow metal, wood and aluminum doors) specified herein, listed in the hardware schedule, and/or required by the drawings.
   2. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
   3. Electro-Mechanical Devices
   4. Access Control components and or systems specified within this section.

B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.
1.3 RELATED WORK IN OTHER SECTIONS

A. This section includes coordination with related work in the following sections:
   1. Division 06.
   2. Division 08.
   4. Division 16.

1.4 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
   1. BMHA - Recommended Locations for Builders' Hardware.
   5. DHI - Door and Hardware Institute
   6. WHI - Warnock Hersey
   7. IBC - International Building Code
   8. TAS – Texas Accessibility Standards

1.5 SUBMITTALS

A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 1 - General Conditions.

B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
   1. Door number, location, size, handing, and rating.
   2. Door and frame material, handing.
   3. Degree of swing.
   4. Manufacturer
   5. Product name and catalog number
   6. Function, type and style
   7. Size and finish of each item
   8. Mounting heights
   9. Explanation of abbreviations, symbols, etc.
   10. Numerical door index, indicating the hardware set/group number for each door.

C. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC) employed by the hardware distributor. The supervising AHC shall attend any meetings related to the project when requested by the architect.

D. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.
E. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or in compatible items, and proposed substitutions in the hardware schedule.

F. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.

G. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 1 - General Conditions.

H. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.

I. Furnish with first submittal, a list of required lead times for all hardware items.

J. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 1 - General Conditions.

K. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.

L. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades.

1.6 QUALITY ASSURANCE

A. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

B. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years experience in successful completion of projects similar in size and scope.

C. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.

D. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.

E. Hardware items not covered in this specification shall be reviewed and approved by Facilities.

F. All Renovations – All products must have prior approval from Facilities.

1.7 DELIVERY, STORAGE AND HANDLING

A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.
B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.

C. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.

D. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.

E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives and a representative from SMU Building Access for above hardware items, and any other effected subcontractors or suppliers.

C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division One General Requirements.

B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

A. All exposed fasteners shall be Phillips head or as otherwise specified, and shall match the finish of the adjacent hardware. All fasteners exposed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.

B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

A. Acceptable manufacturers and respective catalog numbers:
1. Heavy Weight, Ball Bearing
   5BB1HW  
   2. Heavy Weight, Ball Bearing, Non-Ferrous
   5BB1HW

B. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
   1. 3 hinges for doors up to 90 inches.
   2. 1 additional hinge for every 30 inches of fraction thereof on doors over 90 inches.

C. Unless otherwise specified, furnish hinge weight and type as follows:
   1. Heavyweight: 5 knuckle ball bearing hinge 5BB1HW for interior openings.
   2. Heavyweight: 5 knuckle bearing hinge 5BB1HW (Stainless steel) for exterior openings.

D. Unless otherwise specified, furnish hinges for exterior doors, fabricated from stainless steel.

E. Unless otherwise specified, furnish hinges in the following sizes:
   1. 4-1/2” x 4-1/2” 1-3/4” thick doors.

F. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.

G. Furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at out-swinging lockable doors.

H. Unless otherwise specified, furnish all hinges to template standards.

2.3 CONTINUOUS ALUMINUM GEARED HINGES

A. Acceptable manufacturers and respective catalog numbers—all continuous hinges on electrified doors must be prepped for EPT-10 power transfer hinges:

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<th>Hager</th>
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<tbody>
<tr>
<td>1</td>
<td>Full Mortise Aluminum Geared Continuous Hinge</td>
<td>112HD</td>
<td>SL11HD</td>
</tr>
<tr>
<td>2</td>
<td>Full Mortise – Edge Protected Aluminum Geared Continuous Hinge</td>
<td>224HD</td>
<td>SL24HD</td>
</tr>
</tbody>
</table>

B. Use at all exterior doors.

C. Continuous hinges shall be full height geared type hinge providing full height door support up to 450 lbs. Edge mount (unless noted otherwise).

D. Construct hinges of 6063-T6 Aluminum material. Continuous hinges shall consist of three (3)-interlocking extrusions in a pinless assembly applied to the full height of the door.

E. All continuous geared hinges shall be manufactured to template screw locations and be non-handed.

F. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 90 minutes.

G. Provide machine screws for doors which have been reinforced to accept machine screws.

H. Hinges shall be prepped to accept Electric Power Transfers at all electrified openings.
I. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

2.4 POWER TRANSFERS

A. Acceptable manufacturers and respective catalog numbers:
   Von Duprin
   1. Concealed Ten Wire
   EPT-10

B. Concealed power transfers shall be concealed in the door and frame when the door is closed.

C. Concealed power transfers shall have a steel tube to protect wires from being cut.

D. Concealed power transfers with spring tubes shall be rejected.

E. Concealed power transfers shall be supplied with a mud box to house all terminations.

2.5 LOCKS AND LATCHES

A. Acceptable Manufacturer:
   1. Grade 1 Mortise: Schlage; L Series 9000.
   2. Grade 1 Cylindrical: Schlage; ND Vandelgard Series RHO.

B. All doors in new construction are to receive online electronic locking door hardware as well as attendant support equipment and door preparation according to Diagrams in Part 4.
   1. Exterior or high volume interior doors: D1, D2
      a. ADA exteriors require card readers, other exteriors to receive card readers as needed.
   2. Normally locked, fire exit only: D3, D4
   3. Mechanical, electrical, telecom rooms and other critical locations where enhanced monitoring/alarms are desired: D5
   4. Interior standard: D6
   5. Special circumstances requiring maglock (i.e. glass doors—NOTE: INTEGRATION WITH FIRE PANEL MANDATORY): D7
   6. Wireless locks (AD400) only approved in special circumstances or retrofits where wiring unfeasable. Approval by SMU OIT and Siemens.

C. Mechanical key override will be installed on all doors and keyed in accordance with SMU key matrix. Key matrix must severely limit issuance (i.e. PD only) of override keys on electronically controlled doors. Override keys will be emergency only.

D. Mortise Locksets shall be used on doors in means of egress.
   1. Classrooms
   2. Main door of dorm room

E. Cylindrical locksets shall be used on all other applications.

F. Lock Functions – Unless otherwise specified:
   Mortise       Cylindrical
   1. Classrooms: L9070       ND94LD
2. Offices: L9050 ND91LD
3. Storerooms: L9080 ND96LD
4. Non-Locking: L9010 ND10S
5. Restrooms: L9040 ND40S
6. Dummy Trim: L9176 ND170
7. Electrified: L9080 PEU-RX (Mortise)

G. Unless otherwise specified, all locks and latches to have:
1. 2-3/4" Backset
2. 1/2" minimum throw latchbolt
3. 1" throw deadbolt
4. ANSI A115.2 strikes

H. Provide guarded latchbolts for all locksets, and latchbolts with sufficient throw to maintain fire rating of both single and paired door assemblies.

I. Length of strike lip shall be sufficient to clear surrounding trim.

J. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

K. Interchangeable core type hardware prohibited.
   1. Note: If interchangeable cores are used, the contractor will be charged for any needed hardware replacement costs.

L. RX-L283 NO (Normally Opened) Contact

2.6 KEYING

A. Contractor will provide permanent cores.

B. Acceptable manufacturers and respective catalog numbers:
   1. Academic buildings – Cylinders shall be Abloy Pro Standard Core.
   2. Housing Buildings – Cylinders shall be Medeco Standard Core.
   3. Off Campus Buildings – Cylinders shall be Abloy Pro Standard Core.

C. Keying shall be by the Contractor with the assistance of the SMU Building Access Department and the Building Manager. Contractor to submit Key Matrix to Owner for written approval prior to ordering keys.

D. Master keys to be delivered by registered mail to the contractor.

E. Locksets shall be ordered less cylinder and construction cylinders shall be provided during the construction period. Construction Cores shall be 6 pin Schlage C123 Everest keyway.

F. The Contractor will be responsible for the installation of permanent cylinders with the direction and supervision of SMU’s Building Access Department.

G. Keying at card reader controlled doors: Mechanical key override will be installed on all doors and keyed in accordance with SMU key matrix. Key matrix must severely limit issuance (i.e. PD only) of override keys on electronically controlled doors. Override keys will be emergency only.
2.7 EXIT DEVICES

A. Acceptable Manufacturer:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
</tr>
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<tbody>
<tr>
<td>Von Duprin</td>
<td>QEL 99 Series</td>
</tr>
<tr>
<td></td>
<td>QEL 33 A Series</td>
</tr>
</tbody>
</table>

B. Obtain exit devices from a single manufacturer.

C. Exit devices shall be used at all Exterior Egress doors, Fire Exit Doors and Stairwell Doors.

D. Provide breakaway or 99NL-F exterior trim on all doors.

E. Provide throughbolts for all exterior devices.

F. Provide standard hex-key dogging on all non-fire rated devices. Cylinder dogging shall be used only at the request of Facilities.

G. Provide exterior pairs and interior non-corridor pairs of doors with keyless removable steel mullions (KR4954).

H. All exterior doors with electronic access (card readers, etc.) control shall be furnished with QEL function (Quiet Electric latch retraction) panic devices. Provide 902 power supply with option required to fit application and LXRX Switches and Night Latch function. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.

I. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.

J. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.

K. All exit devices shall be provided with flush end caps to reduce potential damage from impact.

L. All exit devices shall be provided with dead-locking latchbolts to ensure security.

M. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.

N. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.

O. Coordinate with related trades to insure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.

P. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
Q. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.

R. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.

S. Devices specified are designed for wide style doors. If door size will not allow for the wide style device, provide the appropriate device to fit the door specified.

T. All exit devices must have LXRX and Night Latch function.

### 2.8 CLOSERS

**A.** Acceptable Manufacturer:
1. LCN 4041.
2. LCN 1461.
3. No substitutions.

**B.** Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

**C.** Closers shall use high strength cast iron cylinders, forged main arms, and 1 piece forged steel pistons.

**D.** Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

**E.** Provide closers for all labeled doors. Provide closers with adjustable spring power. Size closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.

**F.** Supply appropriate arm assembly, drop plates and mounting brackets where required for each closer to ensure that the closer body and arm are mounted on the non-public side of the door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

**G.** Pressure Relief Valve, PRV, shall not be acceptable.

**H.** All closers shall have a factory documented ten (10) year warranty.

### 2.9 LOW ENERGY ELECTRO-MECHANICAL AUTOMATIC OPERATORS

**A.** Acceptable manufacturers and respective catalog numbers:
1. Electro-Mechanical Operator:
   a. LCN; 9500 Sr. Swing.
   b. Besam; 450 Series.

**B.** Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.
C. Operator operation shall consist of Motion Sensors, or a touch-free Motion Sensor, as specified in hardware sets.

D. Operators shall comply with ANSI A156.19, UL 325, and the American with Disabilities Act.

E. In event of power failure, make door operate manually with controlled spring close as though equipped with a #3 manual door closer, without damage to operator components.

F. Provide adjustment by microprocessor control for:
   1. Opening speed – up to 32 seconds.
   2. Backcheck.
   3. Hold-open, from 15 to 30 seconds.
   4. Closing speed – up to 32 seconds.
   5. Opening force – 11 lbs.
   6. Acceleration during opening and recycling, for soft start.
   7. Door will safely stop and reverse if an object is encountered in the opening or closing cycle.

G. Operator equipment shall be completely electromechanical and include the following features:
   1. Close and center door against stop after each cycle, and hold against drafts, winds and stack pressure.
   5. Control box and motor/gear box shall be contained in protective housing; utilize precision-machined gears and bearing seats, all-weather lubricant, and shall be mounted on vibration isolators.
   6. Gears shall be manufactured by operator manufacturer specifically for operators.
   7. Motor shall consist of a DC permanent magnet motor with shielded ball bearings.
      Motor shall stop when door stops or is fully open and when breakaway is operated.
   8. Door operating arm shall be fabricated from forged steel and attached at natural pivot point of door. Do not use slide block in top of door.
   9. Exposed arms shall be factory-polished and finished to match operator enclosure.
  10. Control circuits for actuators and safeties shall be low-voltage, NEC Class II.
  11. Power operators will require 115 VAC power supply.

H. Enclosure shall consist of a extruded aluminum header concealing all operating parts except arms and manual control switches.

I. Wall mounted actuators shall consist of a 4-1/2 inch touch-free Motion sensor with a blue filled handicapped symbol. Switches shall be weather resistant and mount on a single gang electrical box furnished by Division 16. Switches shall be Radio Frequency ID (RFID).

J. Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

2.10 OVERHEAD STOPS

A. Acceptable manufacturers and respective catalog numbers:
B. Overhead stops (including slide block and end caps) shall be fabricated from metal.

C. Unless otherwise specified, furnish Heavy Duty overhead stop for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

D. Do not provide holder function for labeled doors.

2.11 FLUSH BOLTS AND DUST PROOF STRIKES

A. Acceptable manufacturers and respective catalog numbers:

<table>
<thead>
<tr>
<th></th>
<th>Ives</th>
<th>Rockwood</th>
<th>Hager</th>
<th>McKinney</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Dust Proof Strike</td>
<td>DP2</td>
<td>570</td>
<td>280X</td>
<td>DP1</td>
</tr>
<tr>
<td>2 Constant Latching Flush Bolt</td>
<td>FB51/FB61</td>
<td>1845/1945</td>
<td>293D/294D</td>
<td>FB07M/FB11W</td>
</tr>
<tr>
<td>3 Manual Flush Bolt</td>
<td>FB458</td>
<td>555</td>
<td>282D</td>
<td>FB01M</td>
</tr>
</tbody>
</table>

B. Unless otherwise specified, provide 12" rods for manual flushbolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".

C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.

D. Provide all flushbolts with non-locking dust proof strikes.

2.12 PULLS, PUSHBARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

<table>
<thead>
<tr>
<th></th>
<th>Ives</th>
<th>Rockwood</th>
<th>Hager</th>
<th>Trimeco</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Straight Pull (3/4&quot; dia., 10&quot; ctc)</td>
<td>8102-0</td>
<td>108</td>
<td>Equivalent</td>
<td>Equivalent</td>
</tr>
<tr>
<td>2 Push Plate (.050 6&quot;X 16&quot;)</td>
<td>8200 6&quot; X 16&quot;</td>
<td>70C</td>
<td>Equivalent</td>
<td>Equivalent</td>
</tr>
</tbody>
</table>

B. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3' less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.13 COORDINATORS

A. Acceptable manufacturers and respective catalog numbers:

<table>
<thead>
<tr>
<th></th>
<th>Ives</th>
<th>Door Controls</th>
<th>Rockwood</th>
<th>Hager</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bar Coordinator</td>
<td>COR x FL</td>
<td>600 x Filler</td>
<td>1600 Series</td>
<td>297D x 297F</td>
</tr>
<tr>
<td>2 Mounting Bracket</td>
<td>MB Series</td>
<td>AB, C Series</td>
<td>1601</td>
<td>297 Series</td>
</tr>
</tbody>
</table>

B. Provide coordinators at all pairs of doors having automatic/constant latching flushbolts and closers on the inactive leaf, and for pairs of doors having vertical rod/mortise exit device combinations with overlapping astragals.

C. Provide appropriate filler bars, closer mounting brackets, carry bars, and special top latch preparations as required by adjacent hardware.
2.14 KICK PLATES AND MOP PLATES

A. Furnish protective plates as specified in hardware groups.

B. Where specified, provide 10" kick plates, 36" armor plates (maximum 40"), and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick.

C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.

D. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

E. Must match finish of door hardware.

2.15 WALL STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

<table>
<thead>
<tr>
<th>Ives</th>
<th>Trimco</th>
<th>Rockwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrought Convex Wall Bumper</td>
<td>WS406CVX</td>
<td>232W</td>
</tr>
<tr>
<td>Wrought Concave Wall Bumper</td>
<td>WS406CCV</td>
<td>236W</td>
</tr>
<tr>
<td>Exterior Door Stop</td>
<td>FS18S</td>
<td>1209</td>
</tr>
<tr>
<td>Interior Floor Stop</td>
<td>FS436/FS438</td>
<td>1210/1212</td>
</tr>
</tbody>
</table>

B. Furnish a stop or holder for all doors. Furnish floor stops only where specified.

C. Where wall stops are not applicable, furnish overhead stops.

D. Do not provide holder function for labeled doors.

E. Floor stops shall be used at exterior doors and at rooms that have an unoccupied space.

2.16 MAGNETIC HOLD OPENS

A. Preferred Manufacturer:

1. LCN SEM 7800 Series.
2. Rixson FM998 Series.

B. Magnetic holder's housing and armature shall be constructed of a die cast zinc material.

C. Magnetic holder's housing shall be constructed of a plastic material.

D. Provide types as listed in groups.

E. Where wall conditions do not permit the armature to reach the magnet, provide extensions.

F. Magnetic holders shall be tied to fire alarm control panel (FACP) and meet all city and fire code requirements.

G. Provide proper voltage and power consumption as required by Division 16.

H. Coordinate electrical requirements and mounting locations with other trades.
2.17 WEATHERSTRIP, GASKETING

A. Acceptable manufacturers and respective catalog numbers:

<table>
<thead>
<tr>
<th>Product</th>
<th>NGP</th>
<th>Pemko</th>
<th>Mckinney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weatherstrip</td>
<td>130NA</td>
<td>315CR</td>
<td>MCK171A</td>
</tr>
<tr>
<td>Smoke Seal</td>
<td>2525</td>
<td>S88</td>
<td>MCKS88</td>
</tr>
<tr>
<td>Astragal</td>
<td>125N</td>
<td>305N</td>
<td>MCK305N</td>
</tr>
<tr>
<td>Sweeps</td>
<td>C627A/600</td>
<td>345AP/18041CP</td>
<td>MCK345AP/MCK18041CP</td>
</tr>
<tr>
<td>Drip Cap</td>
<td>16</td>
<td>346</td>
<td>MCK346</td>
</tr>
</tbody>
</table>

B. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.

C. Provide weatherstripping all exterior doors and where specified.

D. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.

E. Provide 2525 smoke gaskets at all fire rated doors and smoke and draft control assemblies.

2.18 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:

<table>
<thead>
<tr>
<th>Product</th>
<th>Pemko</th>
<th>NGP</th>
<th>Reese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saddle Thresholds</td>
<td>171A</td>
<td>425</td>
<td>S205</td>
</tr>
</tbody>
</table>

B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.

2.19 MISCELANEOUS ELECTROMECHANICAL PRODUCTS

A. Electric Strike – Acceptable manufacturers:

<table>
<thead>
<tr>
<th>Type</th>
<th>Von Duprin</th>
<th>HES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6000 Series</td>
<td>8500 Series</td>
</tr>
<tr>
<td>2</td>
<td>5000 Series</td>
<td>8000 Series</td>
</tr>
</tbody>
</table>

B. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

C. Door Position Switch – Acceptable manufacturers:

<table>
<thead>
<tr>
<th>Shackle Electronics</th>
<th>Sentrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Concealed</td>
<td>679 Series</td>
</tr>
</tbody>
</table>

D. Computer Managed Locks - Acceptable manufacturers:

E. Online Card reader with key override shall be used at mechanical rooms.

F. Lever trim shall match locksets when available.
G. Provide construction cylinders as required. No interchangeable cores.

H. Provide manufacturer's software when specified.

I. Provide on site training as required by the manufacturer.

2.20 PADLOCKS

A. Padlocks must be ordered through SMU’s lock shop.

B. Preferred Manufacturer:
   1. ABLOY

2.21 CABINET LOCKS

A. Acceptable Manufacturers:
   1. Chicago
   2. National
   3. Timberline
   4. Schlage

B. All locks to a single desk shall be keyed alike.

C. Where space allows and a need for continual entry for operation of duties or a higher security level is needed. Schlage CL100PB may be used.

2.22 FINISHES AND BASE MATERIALS

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

<table>
<thead>
<tr>
<th>HARDWARE ITEM</th>
<th>BHMA FINISH AND BASE MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butt Hinges: Exterior, or Non-Ferrous</td>
<td></td>
</tr>
<tr>
<td>Butt Hinges: Interior</td>
<td></td>
</tr>
<tr>
<td>Continuous Hinges</td>
<td></td>
</tr>
<tr>
<td>Flush Bolts</td>
<td></td>
</tr>
<tr>
<td>Exit Devices</td>
<td></td>
</tr>
<tr>
<td>Locks and Latches</td>
<td></td>
</tr>
<tr>
<td>Pulls and Push Plates/Bars</td>
<td></td>
</tr>
<tr>
<td>Coordinators</td>
<td></td>
</tr>
<tr>
<td>Closers</td>
<td></td>
</tr>
<tr>
<td>Protective Plates</td>
<td></td>
</tr>
<tr>
<td>Overhead Stops</td>
<td></td>
</tr>
<tr>
<td>Wall Stops and Holders</td>
<td></td>
</tr>
<tr>
<td>Thresholds</td>
<td></td>
</tr>
<tr>
<td>Weather-strip, Sweeps</td>
<td></td>
</tr>
<tr>
<td>Drip Caps</td>
<td></td>
</tr>
<tr>
<td>Magnetic Holders</td>
<td></td>
</tr>
<tr>
<td>Magnetic Locks</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
</tbody>
</table>
2.23 EXTRA MATERIALS

A. Provide no fewer than 10% (minimum of 1 but no more than 20) for owner’s maintenance department stock. Verify with Facilities for amounts of each stock item.

B. For smaller projects (less than 20 units) extra materials will be determined by Facilities.

2.24 CARD READERS AND ELECTRONICALLY CONTROLLED DOORS

A. Door control equipment shall be online only.

B. All building exterior doors shall be equipped with online electronically controlled equipment, regardless of card reader presence.
   1. All exterior passages intended to unlock regularly or on a schedule are to be electrified with QEL panic devices.
      a. Exterior card reader placement at the discretion of Facilities; minimum of 1 exterior card reader entrance per building.
   2. Locking handsets requiring manual latch retraction (Schlage AD series, L9080, etc.) shall not be used at medium-high traffic passages.
   3. All exterior ADA doors will receive card readers.
   4. Automatic door openers
      a. Required only at ADA identified doors
      b. Location of exterior push plate to be co-located with card reader on stand-alone pedestal.
      c. Exterior push plate is to be disabled while door/card reader in locked mode (accomplished through override wiring at opener).
   5. Exit only doors (fire escape, no entry) are to receive:
      a. Delayed release equipment with local audible alarms and electronic interface with CCURE
      b. Door position switch

C. Approved card readers (Supplied by Security Installer, though coordination with SMU: AptoIQ CardTrax program)
   1. Contactless readers
      1 Contactless
      2 Contactless w/Keypad
      3 Contactless Mullion

   2. Contactless Integrated handset
      1 Wired
      2 Wired w/Keypad
      3 Wireless
      4 Wireless w/Keypad

   3. Exceptions by SMU OIT

D. Access Controllers
   1. All controllers to be placed within SMU network closets (BDF or IDF)
   2. Only Software House iStar series panels are approved, no exception.
      a. Currently approved iStar series panels include iSTAR Pro (STAR008W, STAR016W, and iSTAR eX (STAREX004, STAREX008. As new product is
added to this series of controllers by Software House, new models may or may not meet SMU’s system layout philosophy. Controllers not listed above must be approved by SMU and/or Siemens before being proposed.

b. All iStar controllers, power supplies with back-up batteries, serial and IP communication interfaces, digital input, and output modules, as specified, shall be furnished and installed by Security Contractor.

E. PIMS (wireless access points for AD-400 handsets)
1. Only Software House model #PIM400-485 serial RS-485 PIM for support of up to sixteen (16) AD400 series wireless readers is approved, no exception.
   a. PIM installed locations shall be verified by field measurement with the use of the manufacturers listed signal strength testing tool (Software House TK400).
   b. Planned PIM installation locations shall be cabled to with a minimum excess of 20ft. (coiled and secured above ceiling) to allow leeway for final PIM placement.
   c. PIM’s shall be powered on individually fused 24VDC circuits with no more than one (1) PIM supported per circuit.
   d. The PIM power supply shall be battery-backed for a minimum calculated duration of ninety (90) minutes.

F. Power Supplies (Controller, and Door)
1. Each access controller (iStar) panel will derive its operational power from a collocated power supply.
   a. Controller power supplies will require a hardwired terminal-strip connection to a dedicated non-switched 110VAC power circuit.
   b. The provided 110VAC power circuit shall be rated for 20A and be on critical power or back-up circuit where available.
2. In addition to the access controller, panel option modules, serial data interfaces, and other panel-based powered components shall also be supported by the controller power supply.
   a. Controller power supply sizing and battery back-up shall be based upon calculated maximum current draw of connected devices.
   b. Power supply sizing shall be verified by OIT and Siemens.
   c. The Access Controller power supply shall be battery-backed for a minimum calculated duration of ninety (90) minutes.
3. Electrified door hardware derives power from a centrally located low voltage DC power supply collocated with and adjacent to access controllers.
   a. Each door lock hardware set, or double door sets, shall be supported on its own individually fused supply circuit.
   b. Door lock power supply sizing shall be based upon calculated maximum current draw of connected devices.
   c. Power supply sizing shall be verified by OIT and Siemens.
4. Proposed power supplies shall be modular, component-based, and field configurable and expandable.
   a. Protected multi-output power distribution modules shall be used to serve controller and controller option modules.
   b. Protected and controlled multi-output power distribution modules shall be used to serve electrified door hardware and devices.
c. Each output of each module in dual-voltage systems shall be individually programmable to provide either 12VDC or 24VDC either constantly, or as triggered.
d. Power supply shall include integral stand-by battery charging capacity.
e. Power supplies and distribution modules shall be LifeSafety Power FlexPower FPO series. Auxiliary power distribution modules shall be D8 / D8P series. Door lock power distribution shall be C8 / C8P series.

G. Cabling
1. Wire shall, at a minimum, meet manufacturer’s specified types and gauges.
   a. Data circuit cables shall feature overall shielding, as specified.
   b. Power circuit wire gauge shall be calculated so that end-of-line voltage drop does not exceed the allowable range of the equipment supported, per manufacturer specification.
2. Security Contractor shall provide cabling and terminations between the security J-box above the door, and door hardware and devices, as noted within the typical door details.
3. Cabling Contractor shall provide cabling between the scheduled BDF / IDF Room access controller and the security J-box above the door. Security door locations shall be cabled to with a minimum excess of 20ft. (coiled and secured above ceiling) by cabling contractor to allow for final cabling to door devices by security contractor.

H. Installation Responsibilities:
1. Door hardware installers
   a. Mount and prep all door hardware
      1) Doorframe Prep
         a) EPT-10
         b) Position switch
         c) Electronic latch (if installed)
      2) Door Prep
         a) EPT-10
         b) Cored for cable to electrified handset or exit trim (if installed)
         c) Drilled to mount electrified handset (if installed)
      3) Provide and install
         a) ADA opener (intelligent), pedestal(s), & buttons.
         b) Fully test opener and buttons.
         c) Door power supplies if required at door (all should be centrally located in closet up to 300 feet away)
         d) Non-credential reader integrated locking hardware (electric latch, QEL, electric handset—EXCLUDES INTEGRATED READER/Locksets I.E. INGERSOLL-RAND AD SERIES LOCKS)
   2. Electricians
      a. Provide power to door power supplies (co-located with access controllers in closet, not close to door in ceiling)
      b. Provide power to access controller power supplies (terminate hard-wired in controller)
      c. Provide conduit needed for low-voltage and access control wires from door location to nearest accessible ceiling
         1) 1 per door for AD locks (at hinge in frame)
2) Up to 3 per door for other hardware
   a) Crashbar (at hinge in frame)
   b) Reader (end in single-gang box on wall or pedestal)
   c) Door contact in doorframe header

3. Data wire pullers
   a. Install network drops for each access controller unit.
   b. Pull and provide access control and low-voltage wires from closet to door
      locations with a spare length equivalent from the ceiling to floor and back,
      coiled in accessible ceiling at entry to conduit at door and at closet.

4. SMU OIT Systems
   a. Configure campus card reader system for devices and set up access
      permissions/schedules.

5. Security Installers
   a. Furnish all integrated reader handsets (i.e. AD-300).
   b. Furnish power supplies at controller (if necessary)
   c. Furnish access controllers
   d. Complete cable run through conduit into door frame for reader,
      latch/crashbar, door position switch as necessary.
   e. Terminate all data/low voltage connections for security hardware
   f. Test and verify operation of all equipment
      1) Electronically controlled doors
         a) Unlock/lock
         b) Credential read (if reader installed)
      2) All doors
         a) Door position
         b) Latch state
         c) RTX
         d) Key override sensor (if installed)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to insure
   frames have been set square and plumb. Installer shall examine doors, door frames, and
   adjacent wall, floor, and ceiling for conditions, which would adversely affect proper
   operation and function of door assemblies. Do not proceed with hardware installation until
   such deficiencies have been corrected.

3.2 INSTALLATION

A. Install all hardware in accordance with the approved hardware schedule and manufacturers
   instructions for installation and adjustment.

B. Set units level, plumb and true to the line and location. Adjust and reinforce the
   attachment substrate as necessary for proper installation and operation.

C. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space
   fasteners and anchors in accord with industry standards.
D. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.

E. Shim doors as required to maintain proper operating clearance between door and frame.

F. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.

G. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

H. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

I. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.

J. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.

K. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

L. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.

M. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.

N. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.

O. Adjust spring power of door closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to insure opening force does not to exceed 5 lbs.

P. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.

Q. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.

R. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water resistant seal.

S. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.
3.3 QUALITY ASSURANCE

A. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.

B. After installation has been completed, the hardware supplier and manufacturers representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware.

C. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.

3.4 ADJUSTMENT AND CLEANING

A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.

B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.
PART 4 - Diagrams: Electronic Door Controls

**EXTERIOR SINGLE DOOR, READER (TYPE 1)**
READER, ELECTRONIC EXIT DEVICE w/INTEGRAL REX, ELECTRIC POWER TRANSFER, DOOR POSITION SWITCH, A ADA OPENER (WHERE SCHEDULED ONLY)

**EQUIPMENT LIST**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOT USED</td>
</tr>
<tr>
<td>2</td>
<td>DOOR position switch DC</td>
</tr>
<tr>
<td>3</td>
<td>CARD READER, mit 1/2 INT 16 SC</td>
</tr>
<tr>
<td>4</td>
<td>ELECTRONIC EXIT DEVICE, VD 46-8X8 DC</td>
</tr>
<tr>
<td>5</td>
<td>NOT USED</td>
</tr>
<tr>
<td>6</td>
<td>SINGLE SANG BOX RECESSED IN WALL EC</td>
</tr>
<tr>
<td>7</td>
<td>3½&quot; ENT EC</td>
</tr>
<tr>
<td>8</td>
<td>NOT USED</td>
</tr>
<tr>
<td>9</td>
<td>NOT USED</td>
</tr>
<tr>
<td>10</td>
<td>ELECTRIC POWER TRANSFER, CABLED TO LOCK DC</td>
</tr>
<tr>
<td>11</td>
<td>TRWAC EC</td>
</tr>
<tr>
<td>12</td>
<td>NON RETURN DOOR ACTUATOR * DO</td>
</tr>
<tr>
<td>13</td>
<td>NOT USED</td>
</tr>
<tr>
<td>14</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>

* AUTO DOOR OPENER (ONLY WHERE SCHEDULED)

**DOOR SEQUENCE OF OPERATIONS**
CARD OR KEY OVERRIDE, FREE EGRESS

ENTRY (UNSECURED SIDE):
THE DOOR IS EQUIPPED WITH A CARD READER ON THE PUBLIC SIDE OF THE DOOR TO CONTROL ENTRY INTO A SECURED AREA. ELECTRONIC EXIT DEVICE LOCK w/INTEGRAL REX (MIT 1/2 INT 16 SC) SECURES THE DOOR. DOOR IS EQUIPPED WITH A DOOR POSITION SWITCH (DCV) TO MONITOR THE DOOR POSITION. A VALID CARD READ UNLOCKS THE LOCK, BYPASSING THE CPS, AND ALLOWS NONALARMED ENTRY INTO THE SECURED AREA. THE DOOR IS LOCKED ON THE UNSECURED "PUBLIC" SIDE.

EXIT (SECURED SIDE):
THE DOOR IS EQUIPPED WITH AN ELECTRONIC EXIT DEVICE WITH AN INTEGRAL REX SENSOR. MANUAL ACTIVATION (CRESSING PULL BAR) FROM THE SECURED SIDE ALLOWS FOR FREE NONALARMED EXITING. THE DOOR IS UNLOCKED ON THE SECURE SIDE.

DOOR SUPERVISION:
IF DOOR IS OPENED WITHOUT A VALID CARD READ, OR REX ACTIVATION, A "FORCED DOOR" ALARM WILL BE TRANSMITTED TO THE ACS OPERATORS WORKSTATION.

IF DOOR REMAINS OPEN AFTER THE EXPIRATION OF THE PROGRAMMED INTERVAL, A "PROPPED DOOR" ALARM WILL BE TRANSMITTED TO THE ACS OPERATORS WORKSTATION.
EXTerior double door, reader (type 2)
reader, electronic exit device with integral rix, electric power transfer, door position switch, & aha opener (where scheduled only)

**EQUIPMENT LIST**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>EORR POSITION SWITCH</td>
<td>SC</td>
</tr>
<tr>
<td>3</td>
<td>CARD READER, w/o IDTS</td>
<td>SC</td>
</tr>
<tr>
<td>4</td>
<td>ELECTRONIC EXIT DEVICE, VF DELAY</td>
<td>EC</td>
</tr>
<tr>
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<tr>
<td>6</td>
<td>SINGLE BANK BOXES Recessed in wall</td>
<td>EC</td>
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<tr>
<td>7</td>
<td>3/4&quot; BOLT</td>
<td>BC</td>
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<td>10</td>
<td>ELECTRIC POWER TRANSFER CABLE TO LOCK</td>
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<td>TIE BAR</td>
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<td>ADA BATH DOOR ACTUATOR*</td>
<td>EC</td>
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<td>13</td>
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<td></td>
</tr>
<tr>
<td>14</td>
<td>NOT USED</td>
<td></td>
</tr>
</tbody>
</table>

* AUTO DOOR OPENER ONLY WHERE SCHEDULED

**DOOR SEQUENCE OF OPERATION:**
CARD IN OR KEY OVERRIDE, FREE EGRESS

**ENTRY (UNSECURED SIDE):**
The door is equipped with a card reader on the public side of the door to control entry into a secured area. A card exit device (lock with integral rix, delay, or time-out) ensures the door is only opened with a valid card. If the card is not valid, the door remains closed. A card reader bypasses the rix, and allows nonalarmed entry into the secured area. The door is locked on the unsecured "public" side.

**EXIT (SECURED SIDE):**
The door is equipped with an electronic exit device with an integral rix switch. Manual activation (depressing push bar) from the secured side allows for free nonalarmed exiting. The door is locked on the secured side.

**DOOR SUPERVISION:**
If the door is opened without a valid card read, or rix activation, a "FORGED DOOR ALARM" will be transmitted to the ACS operators workstation. If the door remains open after the expiration of the programmed interval, a "PROP OPEN DOOR" alarm will be transmitted to the ACS operators workstation.
**EQUIPMENT LIST**

<table>
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<td>SINGLE GAIN BOX RECESSED IN WALL</td>
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</table>

**DOOR SEQUENCE OF OPERATIONS**

NO ENTRY, FREE EGRESS ONLY

**ENTRY (UNSECURED SIDE)**

The door is equipped with Exit Only door hardware and is secured to the public side. Door is equipped with a door position switch (DPS) to supervise the door position. The door is locked on the unsecured "public" side with no provisions for entry.

**ENTRY (SECURED SIDE)**

The door is equipped with a mechanical exit device. Manual activation (expressing push bar) from the secured side unlatches the door. Opening the door causes a CPS door alarm signal to be transmitted to the ACS operators workstation. The door is unlocked on the secured side.

**DOOR SUPERVISION**

Any time the door is opened, a "FORCED DOOR" alarm will be transmitted to the ACS operators workstation.

---

**D3**  
**EXTERIOR SINGLE DOOR, MONITOR (TYPE 3)**  
MECHANICAL EXIT DEVICE, DOOR POSITION SWITCH
**EQUIPMENT LIST**

<table>
<thead>
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</tr>
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<td>MECHANICAL EXIT DEVICE</td>
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<tr>
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<td>-</td>
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<tr>
<td>6</td>
<td>SINGLE GANG BOX RECESSED IN WALL</td>
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<tr>
<td>7</td>
<td>1/2&quot; ENT. MINIATURE</td>
<td>EC</td>
</tr>
<tr>
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</tr>
<tr>
<td>11</td>
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</tr>
<tr>
<td>12</td>
<td>ADA AUTO DOOR ACTUATOR</td>
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<td>-</td>
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<tr>
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**DOOR SEQUENCE OF OPERATION:**

NO ENTRY, FREE DEBUG ONLY

**ENTRY (INSECURE SIDE):**

The door is equipped with Exit Only door hardware and is secured to the public side. Doors equipped with a door position switch (DPS) to supervise the door position. The door is locked on the insecure "public" side with no provisions for entry.

**EXIT INSECURE SIDE:**

The door is equipped with a mechanical exit device, manual activation (expressing push-bar) from the secured side unlocks the door, opening the door causes a DPS door alarm signal to be transmitted to the AGC operators workstation. The door is unlocked on the secure side.

**DOOR SUPERVISION:**

Any time the door is opened, a "forced door alarm will be transmitted to the AGC operators workstation."
**EXHIBIT 5**

**INTERIOR SINGLE DOOR, AD300 (TYPE 5)**

**INTEGRATED READER-Lock Device, A Panic Exit Device (WHERE SCHEDULED ONLY)**
DOOR TYPE DESIGNATION:
Hardware arrangement depicted is not a substitute for mechanical keys. It is not to be considered a "security" door and provides no door supervision or monitoring.

INTERIOR SINGLE DOOR, READER (TYPE 6)
READER, ELECTRIC STRIKE

DOOR SEQUENCE OF OPERATION:
CARD IN (OR KEY OVERPRED), FREE EGRESS

ENTRY (UNSECURED SIDE):
The door is equipped with a card reader on the public side of the door to control entry into a secured area, a valid card read releases the strike and allows entry into the secured area. The door is locked on the public side.

EXIT (SECURED SIDE):
The door is unlocked on the secure side.

DOOR SUPERVISION:
There is no door position supervision provided. This is not a security door.
DOOR SEQUENCE OF OPERATIONS
CARD IN, FREE EGRESS, FIA OVERVIEW

ENTRY (UNSECURED SIDE):
The door is equipped with a card reader on the public side of the door to control entry into a secured area. Maglock with integral door sensor secures door. A supervisor in the door position, a valid card read releases the maglock, bypassing the door sensor allowing normal alarm entry into the secured area. The door is locked on the unsecured "public" side.

EXIT (SECURED SIDE):
The door is equipped with a REX PIR, REX push button, and EPS to supervise the door position & status. Approaching the door automatically activates the REX PIR, and/or manually pushing the REX button drops power to the maglock bypassing the EPS allowing normal alarm alarm det. from the secured area. The door is unlocked on the secured side.

DOOR SUPERVISION:
If door is opened without a valid card read, or REX activation, a "forcibly opened door" alarm will be transmitted to the ACS operators workstation.

If door remains open after the expiration of the programmed interval, a "forcibly opened door" alarm will be transmitted to the ACS operators workstation.

INTERIOR SINGLE DOOR, READER (TYPE 7)
READER, MAGLOCK WITH INTEGRAL DPS, REX PIR, REX BUTTON

EXHIBIT 7
enMotion® Recessed Automated Towel Dispenser

**SPECIFICATIONS**

The enMotion® Recessed Automated Towel Dispenser holds and dispenses proprietary hand-wound roll towels. The cover is 24 gauge, #304 stainless steel, #4 AISI satin brush finish, with the grain in the vertical direction.

**Weight:**
6 Pounds
(without batteries or paper installed)

**Dimensions:**
16.48" H x 13.5" W x 7.75" D

**INSTALLATION**

When mounted directly into a wall, the unit is mounted using #10 self-tapping screws. Many possible methods can be used to mount the dispenser, given the wide variety of stud configurations behind the wall. The enMotion® Recessed Automated Towel Dispenser has mounting holes on both sides of the backplate and directly in the rear of the unit. The unit must be mounted flush to the wall, 4" recessed to comply with ADA guidelines. The door of this unit can easily be removed in the event the hinge needs to be on the opposite side.

**OPERATION**

The enMotion® Recessed automated towel dispenser runs on 4 D Cell alkaline batteries (included) or an optional AC power kit, SKU 59477 or 59472. The dispenser features 3 LEDs, from left to right, a low paper indicator, a motor/sensor activation light and a low battery light. It has 2 dispensing modes: on-demand mode, or a paper sheet is presented when a hand is waved in front of the sensor, and a hanging-towel mode, where a new towel is dispensed as soon as a towel is removed from the dispenser.

The enMotion® Recessed dispenser also features adjustable settings for paper length and sheet delay. For more details, see the enMotion® Recessed Automated Towel Dispenser Instruction manual included with the unit.

For questions or comments, please call 1-866-HELLO GP (435-5647)

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August 2012
LOW VOLTAGE AND HIGH VOLTAGE TECHNICAL SPECIFICATION

Electrical
- Input voltage: Low voltage = 100V - 277V, High voltage = 230V/240V
- Frequency: 50 Hz, subject to change
- Power exceeding 60 Hz at 50 Hz
- Rated input: 60 Hz at 60 Hz
- Rated power: Under 3 kW
- Wavelength: Under 3.00 m
- Wavelength: Under 3.00 m

Construction
- 100V - 277V
- 230V/240V
- 50 Hz, subject to change
- 60 Hz at 50 Hz
- 60 Hz at 60 Hz
- Under 3 kW
- Under 3.00 m

Filter
- HEPA filter
- Glass filter
- Fleece prefilter
- 100V - 277V
- 230V/240V
- 50 Hz, subject to change
- 60 Hz at 50 Hz
- 60 Hz at 60 Hz
- Under 3 kW
- Under 3.00 m

Operation
- 100V - 277V
- 230V/240V
- 50 Hz, subject to change
- 60 Hz at 50 Hz
- 60 Hz at 60 Hz
- Under 3 kW
- Under 3.00 m

Logistics
- 100V - 277V
- 230V/240V
- 50 Hz, subject to change
- 60 Hz at 50 Hz
- 60 Hz at 60 Hz
- Under 3 kW
- Under 3.00 m

Accessories
- Carry case
- NSF certification
- 6-year warranty
- 6-year warranty

For further information, please contact Dyson: 1-855-726-8289, www.dyson.com/airblade
dyson airblade V

TECHNICAL SPECIFICATION

REAR ELEVATION

SIDE ELEVATION

Machine dimensions:

- Height 15" With 6% Depth 4"

Minimum clearance:

2" clearance either side and 1" above machine.

For further information, please contact Dyson: 1-855-728-6669,
www.dyson.com/airblade

Last Revision:
June 2019

Building Construction and Materials
B-4C - 3
**XLERATOR® HAND DRYER**

**MODELS:** XL-8W, W, GR, C, SB, SI, SP

**OPTIONS:** -1.1N (Noise Reduction Nozzle), -H (HEPA Filter)

---

**PERFORMANCE**

A. Dry Time: 10 Seconds

B. Wattage: 1450 Watts (Heat On), 125 Watts (Heat Off)

C. Certification:

---

**CONSTRUCTION**

A. All covers will be finished to a base plating of chrome-plated tangerine-proof parts. Cover shall be one of the following:

- **Die-cast zinc alloy** - One-piece, heavy-duty, rib-reinforced, lightweight, unbreakable, rustproof and all exposed surfaces shall be bright chrome-plated or finished with a film-feel, electrostatically applied powder paint.

- **Built-in Molding Compound (BMC)** - White-reinforced thermoset resin.

B. Base plate shall be equipped with 3 7/8" (22 mm) diameter holes; the bottom one is suitable for use with surface contact.

C. All internal parts shall be coated according to Underwriters Laboratories requirements.

D. Entire mechanism shall be internally grounded.

---

**MECHANISM**

A. Motor shall be a thermally protected, series-commutated, through-flow discharge vacuum microblower (4 hp / 20,000 rpm) which provides an air velocity of up to 18,000 LFM linear foot per minute at the air outlet and 18,000 LFM at the hands (2 inches / 50 mm) below air outlet.

B. Heating element (970 watts) is constructed of Nichrome wire and mounted inside the blowout housing, thereby being water resistant. It shall be protected by an automatic resetting thermostat, which shall open whenever air is cut off and shall close when flow of air is resumed. It shall produce an air temperature of up to 110°F (43°C) at a 71°F (22°C) ambient room temperature at the hands (5 inches / 127 mm) below air outlet.

C. Control assembly is equipped by an infrared optical sensor located just below the air outlet. The dryer shall operate as long air flow is at the air outlet. Control includes 4-speed and sound control mechanisms, variable heat control with high, medium, low and OFF settings and a filter sensor which is activated should the filter become clogged. There is a 30-second knockout feature if hands are removed. Sensor equipped with externally visible Aprilaire™ Element Filter or equivalent sensors to assist in trouble shooting.

---

**LIMITED WARRANTY**

The dryer shall be guaranteed to be free from defects for a period of five (5) years. Warranty shall include labor performed at factory as well as the repair or exchange of defective parts, at manufacturer's option.

---

**QUANTITY RECOMMENDATIONS**

One dryer for every two washrooms is sufficient for most applications. Inasmuch as there is generally heavy, we suggest one dryer per washroom in small installations and two dryers for every three washrooms in large installations. Where a four washroom is to be used, we suggest four to five dryers.

---

**FOR ARCHITECT/ENGINEER APPROVAL**

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<th>Model Specified</th>
<th>Date</th>
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**EXCEL DRYER, INC.**

East Longmeadow, MA

Phone 1-800-239-3135
Fax 1-413-527-7153
sales@exceldryer.com
www.exceldryer.com

December 2015
XLERATOR® HAND DRYER

MODELS: XL - 8W V 6R G 5C 4S 3P 2I 1C 0SP OPTIONS: -1N (Noise Reduction Nozzle) -H (HEPA Filter) -V (Voltage) (See Chart)

**SIDE VIEW**

Dimension: Width 11 1/4" (286 mm) Height 12 1/8" (322 mm) Depth 6 7/8" (170 mm)

**FRONT VIEW FACING WALL**

Location of additional mounting holes for more secure installation

**DIMENSIONS**

- Width: 11 1/4" (286 mm)
- Height: 12 1/8" (322 mm)
- Depth: 6 7/8" (170 mm)

**WEIGHT**

- XL DW: 16 lbs. (7.3 kg)
- XL SB: 16 lbs. (7.3 kg)
- XL V, G, C, S, P: 17 lbs. (7.7 kg)

**ELECTRICAL**

- **Volts**: 110-120V, 208-277V, 230V
- **Amps**: 11.2 to 12.2A, 5.6 to 6.2A, 6.1A
- **Watts**: 450-560W, 1400-1500W, 1110W
- **Heat Watts**: 450-560W, 1400-1500W, 1110W

**SUGGESTED MOUNTING HEIGHTS**

- **Man**: 49" (124 cm)
- **Women**: 43" (109 cm)
- **Teenagers**: 41" (104 cm)
- **Small Children**: 36" (91 cm)
- **Handicapped**: 37" (94 cm)

**ACTIVATION**

Automatic Sensor Operated

**MOUNTING**

Surface Mounted

**OPTIONAL ADA-COMPLIANT RECESS KIT**

Part # 40502

**DIMENSIONS**

- Width: 16 7/8" (424 mm)
- Height: 26" (660 mm)
- Depth: 3 3/4" (96 mm)

**WEIGHT**

- 11 lbs. (4.9 kg)

Bottom of recessed wall box should be 10" (254 mm) below suggested mounting height for dryer.
enMotion® Recessed Automated Towel Dispenser

PARTITION CUT-OUT REQUIRED
is 10.6” W x 15.1” H x 4” D or [270mm W x 388 H x 102 D]

The installation description and illustration herein are to serve as a guide. Georgia-Pacific reserves the right to make changes and improvements in design, dimensions and subsequent installation instructions. Georgia-Pacific does not take responsibility for any damage, or injury to persons or property or any other incidental or consequential losses due to those installation instructions. Georgia-Pacific recommends the use of a professional installation service.

SPECIFICATIONS
The enMotion® Recessed Automated Towel Dispenser holds and dispenses proprietary hand wound roll towel. The cover is 24 gauge, #304 stainless steel, #4 AISI satin brush finish, with the grain in the vertical direction.

- Weight: 6 Pounds
  (without batteries or paper installed)
- Dimensions: 16.48” H x 13.5” W x 7.75” D

INSTALLATION
When mounted directly into a wall, the unit is mounted using #10 self-tapping screws. Many possible methods can be used to mount the dispenser, given the wide variety of stud configurations behind the wall. The enMotion® Recessed Automated Towel dispenser has mounting holes on both sides of the backplate and directly in the rear of the unit. The unit must be mounted flush to the wall, 4” recessed to comply with ADA guidelines. The door of this unit can easily be removed in the event the hinge needs to be on the opposite side.

OPERATION
The enMotion® Recessed Automated Towel dispenser runs on 4 D Cell alkaline batteries (included) or an optional AC power kit SKU 59477 or 59472. The dispenser features 3 LEDs, from left to right, a low power indicator, a motor/sensor activation light and a low battery light. It has 2 dispensing modes: an on-demand mode, where a new sheet is presented when a hand is waved in front of the sensor, and a hanging-towel mode, where a new towel is dispensed as soon as a towel is removed from the dispenser. The enMotion® Recessed dispenser also features adjustable settings for paper length, and sheat delay. For more details, see the enMotion® Recessed Automated Towel Dispenser Instruction manual included with the unit.

For questions or comments, please call 1-866-HELLO GP (435-5647)

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August 2012
**GP Recessed Trash Receptacle Unit – For 12” Wall Cavity**

**TOP VIEW**
- In Wall
- In Room

**SIDE VIEW**
- Finished face of wall
- Wall cut out

**FRONT VIEW**
- Installer to observe ALL state & local ADA Guidelines

**Operation**
The emMotion recessed dispenser operates on 4 "D" size alkaline cell batteries (included). The dispenser features 3 LEDS, including a low power indicator, a motor/sensor activation light and a low battery light. It has 2 dispensing modes: an on-demand mode, where a new sheet is presented when a hand is waved in front of the sensor; a hanging towel mode, where a new towel is presented as soon as the exposed towel is removed. The emMotion recessed automated towel dispenser also features adjustable settings for paper length, sensor range, and sheet delay. For more details see the emMotion Recessed Automated Towel dispenser instruction manual included with unit.

**Pictured above is the 59451 trash receptacle and the emMotion Recessed dispenser (Model 59441), which must be ordered separately.**

**Model Specifications**
The emMotion Recessed Automated Towel Dispenser and trash Receptacle holds and dispenses proprietary hand-wound roll towels and includes a waste receptacle, all within a unitary self-contained package. The unit is semi-recessed, with an integral one-piece molded outer frame, providing a pleasing appearance to the wall. The dispenser mounts easily and naturally into this unit for a "Perfect Fit". The trash receptacle unit is constructed entirely from 18 gauge type 304 stainless steel with a brushed stainless finish. All exposed edges are hemmed and corner rounded to ensure a smooth finish for consumer use. The exposed nose front panel is at a one-piece construction providing a unitary clean appearance. The waste receptacle is securely placed, and accessed by a hinged door with generous contoured corners for a pleasing appearance. The waste receptacle itself is made from heavy-duty container providing a sturdy, yet light weight way to handle container for maintenance personnel. The swing-out access door is attached with a concealed fastening pin hinge and secured with a locking mechanism. Unit capacity is 2 gallons.
enMotion® Impulse™ 8 Automated Towel Dispenser

The installation description and illustration herein are to serve as a guide. Georgia-Pacific reserves the right and does from time to time make changes and improvements in design, dimensions, and subsequent installation instructions. Georgia-Pacific does not take responsibility for any damage, or injury to persons or property or any other incidental or consequential losses due to these installation instructions.

**OPERATION**

The Automated Towel dispenser runs on three D Cell alkaline batteries (included). The dispenser features three LEDs, from left to right: a low paper indicator, a motion/sensor activation light and a low battery light. It has two dispensing modes: an on-demand, where a new sheet is presented when a hand is waved in front of the sensor, and a hanging towel mode, where a new towel is dispensed as soon as a towel is removed from the dispenser. The dispenser also features adjustable settings for paper length and sheet delay. For more details, see the enMotion® Impulse™ Automated Towel dispenser Instruction manual included with the unit.

**SPECIFICATIONS**

- The cover and back housing are constructed of plastic.
- **Weight**: 6.5 Pounds (without batteries or paper installed)
- **Dimensions**: 13.12"H x 13.23"W x 9.50"D

**INSTALLATION**

When mounted directly into a wall, the unit is mounted using #10 self-tapping screws. Many possible methods can be used to mount the dispenser, given the wide variety of stud configurations behind the wall. The enMotion® Impulse™ 8 Automated Towel dispenser has mounting holes on both sides of the backplate and directly in the rear of the unit.

For questions or comments, please call 1-866-HELLO GP (435-5647) or visit our website at www.gp.com/awayfromhome

June 12, 2008
Compact® Stainless Steel Side-by-Side 2-Roll Dispenser
specification and mounting sheet

Loading Instructions:

1. Front
2. Side
3. Wall

Overall Dimensions:
Dispenser: 10.9" W x 6.9" H x 6.9" D

Overall Weight:
Dispenser: 3.25 lbs (1.47kg)

Capacity:
2 rolls of Compact® Coreless Tissue.

For questions or comments, please call
1-866-HELLO GP (435-5647)

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Café Express

Compact® Side-By-Side Double Roll Bathroom Tissue Dispenser

Coreless bath tissue dispensing system provides up to 0,000 sheets of tissue. Replaces 53771.01

Description:

Attractive Compact double roll, side-by-side coreless bathroom tissue dispensing system provides up to six times the capacity of single standard 2-ply rolls while maintaining your professional look. This dispenser delivers 3000 sheets of quality 2-ply tissue or 6000 sheets 1-ply for continuous service and increased patron satisfaction. Featuring a transfer paddle to prevent access to a new roll before the current roll is completely used up, this dispenser offers one of the most cost-effective solutions for high-capacity toilet paper dispensing.

Features & Benefits:

- 3x the 2-ply Capacity: Delivers 3000 sheets of 2-ply or 6000 sheets of 1-ply toilet paper to help reduce run-out and improve customer satisfaction.
- 97% Satisfaction: 97% of customers who use Compact® Toilet Paper Dispensers are overwhelmingly satisfied with their performance. *(Source: GP PRO Proprietary Research: CBT-15-127)*
- 95% Less Packaging: Compared to GP PRO standard toilet paper by eliminated cardboard cores, inner wraps and other corrugated materials.
- Reduces Waste: Transfer Paddle deters early access to new roll, reducing stub roll waste
- Easy To Maintain: Easy install, locking dispenser helps prevent pilferage
- Easy To Install: Optional mounting brackets provide for easy installation and cleaning.

Product Details

- Brand Owner: GP
- Brand: Compact®
- MFG Part#: 56784
- Color: Translucent Smoke
- UP - UPC: 073310567848
- Each Per Ship Unit: 1 Each
- Items Per Each: 0 Each
- Case Total: 1 Each
- Dispenser (WxHxD): 10.1” x 6.8” x 7.1”
- UNSFSC: 47131710
- Replaces Item: 53771.01, 53781, 53782, 53793, 53704
- Buy Multiple: 1 EA

Case Shipping Info

- Case GTIN: 00073310567846
- Case Gross Wgt: 1.340 LBS
- Case Net Wgt: 1.640 LBS
- Case Dimensions (LxWxH): 11.75” x 7.53” x 7.18”
- Case Volume: 0.375 CFT

Unit Shipping Info

- Ti-Qty/Layer: 20
- Hi-Layers/Unit: 6
- Unit Qty: 120
- Unit Dimensions (LxWxH): 46.175” x 38.750” x 43.125”

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Georgia-Pacific Soap Dispenser Specification Sheet

**INSTALLATION**
Install dispenser using bracket provided.
Note Mounting should comply with ADA Guidelines.
Compliance is the responsibility of the installer.

**Installation with bracket and screws**
1. Position bracket and mark holes using the bracket as a template.
2. Drill holes and attach bracket using appropriate anchors and screws.
3. Align dispenser on bracket and gently push downward until it clicks.
4. To remove press dispenser release tab while lifting the dispenser upward.

**Installation with bracket and tape**
1. Clean bracket and mounting surface with alcohol pad.
2. Attach tape to bracket and position bracket on wall.
3. Press bracket firmly to wall for 30 seconds.

*Caution - Wait 24 hours before attaching dispenser.*

The installation description and illustration herein are to serve as a guide. Georgia-Pacific reserves the right to make changes and improvements in design, dimension, and subsequent installations. Georgia-Pacific does not take responsibility for any damage, injury to persons or property or any other incidental or consequential losses due to these installation instructions.

**SPECIFICATIONS**
This Georgia-Pacific soap dispenser only dispenses Pacific Garden® 1200 mL product refills. The dispenser features two adjustable portion control settings that dispense approximately 0.6 mL or 0.7 mL per activation. The dispenser also allows the use of either a push button or key lock. The dispenser is constructed of high strength, low maintenance polymer materials.

<table>
<thead>
<tr>
<th>Overall Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispenser: 5.68&quot; W x 10.75&quot; H x 5.25&quot; D</td>
<td>Dispenser: 1.4 lbs (0.64 kg)</td>
</tr>
</tbody>
</table>

Need Assistance? Contact Georgia Pacific at:
1-888-HELLO GP (1-888-435-5647) www.gppro.com

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INSTALLATION
Install dispenser using bracket provided.
Note: Mounting should comply with ADA Guidelines. Completion is the responsibility of the installer.

Installation with bracket and screws
1. Position bracket and mark holes using the bracket as a template.
2. Drill holes and attach bracket using appropriate anchors and screws.
3. Align dispenser on bracket and gently push downward until it clicks.
4. To remove, press dispenser release tab while lifting the dispenser upward.

Installation with bracket and tape
1. Clean bracket and mounting surface with alcohol pad.
2. Attach tape to bracket and position bracket on wall.
3. Press bracket firmly to wall for 30 seconds.
Caution - Wait 24 hours before attaching dispenser.

The installation description and illustration herein are to serve as a guide. Georgia-Pacific reserves the right to make changes and improvements in design, dimension, and subsequent installations. Georgia-Pacific does not take responsibility for any damage to persons or property or any other incidental or consequential losses due to these installation instructions.

SPECIFICATIONS
This enMotion™ automated touchless dispenser operates on four D size alkaline batteries and only dispenses enMotion™ 1000 mL or 1200 mL soap bag refills. The dispenser features two adjustable portion control settings that dispense approximately 0.4 mL and 0.7 mL of foam or 0.7 mL and 1.2 mL of non-foam products per activation. The dispenser has two LEDs to indicate dispenser activation and low battery power. The dispenser allows the use of either a push button or key lock. The dispenser is constructed of high strength, low maintenance polymer materials and features a maintenance mode which temporarily disables the dispenser for easy cleaning.

Overall Dimensions
Dispenser: 6.68” W x 11.06” H x 3.88” D

Weight
Dispenser: 2.0 lbs (0.91 kg)
**ConturaSeries® SURFACE-MOUNTED SANITARY NAPKIN DISPOSAL**

**B-270**

**Technical Data**

**MATERIALS:**
Container — 18-8 S, type-304, 22-gauge (0.8mm) stainless steel. All-welded construction. Exposed surfaces have satin finish. Integral finger depression for opening cover. Front of container has same degree of arc as front of cover and other Bobrick ConturaSeries washroom accessories. Radius on side edges of container match corners and edges of cover and other ConturaSeries accessories.

Cover — 18-8 S, type-304, 22-gauge (0.8mm) stainless steel with satin finish. Drawn, one-piece, seamless construction. Front of cover has same degree of arc as front of container and other Bobrick Contura Series washroom accessories. Radius on corners and edges of cover match side edges of container and other ConturaSeries accessories. Secured to container with a full-length stainless steel piano-hinge.

**OPERATION:**
Cover flips up for disposal of sanitary napkins and for servicing container. Disposable paper liners for the container are available as an optional accessory; order Bobrick Part No. 27012.

**INSTALLATION:**
For partitions with particle-board or other solid core, secure with two #8 x 3/4" (4.2 x 19mm) sheet-metal screws (not furnished) at all points indicated by an S, or provide through-bolts, nuts, and washers.

For hollow-core metal partitions, provide solid backing into which sheet-metal screws can be secured. If two units are installed back-to-back, then provide threaded sleeves and machine screws for the full thickness of partition.

For masonry walls, provide fiber plugs or expansion shields for use with sheet-metal screws, or provide 3/16" (5mm) toggle bolts or expansion bolts.

For plaster or dry wall construction, provide concealed backing to comply with local building codes, then secure unit with sheet-metal screws.

**SPECIFICATION:**
Surface-mounted sanitary napkin disposal shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Front of sanitary napkin disposal shall have same degree of arc and match other Bobrick ConturaSeries® accessories in the washroom. Radii on corners and edges of sanitary napkin disposal shall complement other Bobrick ConturaSeries® washroom accessories. Cover shall be drawn, one-piece, seamless construction and secured to container with a full-length stainless steel piano-hinge. Container shall have integral finger depression for opening cover. Manufacturer's service and parts manual shall be provided to the building owner/manager upon request.

Surface-Mounted Sanitary Napkin Disposal shall be Model B-270 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

*The illustrations and descriptions herein are replicable to production as of the date of this Technical Data Sheet. The manufacturer reserves the right to, and does from time to time, make changes and improvements in designs and dimensions. Revised 6/98*
AGP-1700 Series
Parking Gate—Lighted or Non-Lighted

Amano McGann's AGP-1700 Series Parking Gate is designed to meet all your parking control needs. The microprocessor-based logic and functionality provides the ultimate in reliability, performance, and safety, as well as the flexibility to accommodate four different modes of operation.
1.0 Non-Proprietary Elevator Equipment

1.1 Equipment and component parts installed, supplied or provided under this contract shall be manufacturer's non-proprietary equipment or shall be manufactured and distributed by a third-party, non-installer company regularly engaged in serving the elevator industry. Acceptable is Motion Control Engineering, Electronic Controls inc., or Galaxy Elevator Controls.

1.2 Equipment and component systems shall not employ any proprietary designs that could hamper and/or otherwise prohibit subsequent maintenance, repairs or adjustments by all qualified contractors.

1.3 Manufacturer’s of apparatus shall provide parts replacement on open market to all maintenance providers for equipment and component systems for as long as said parts are available to ensure apparatus or systems remain maintainable regardless of who may be selected for future service. Prior to final acceptance complete parts manuals for all major and minor component parts shall be provided.

1.4 Prior to final acceptance a complete set of as-built, "adjustor-level" wiring diagrams shall be provided to the Owner along with any nomenclature documents in both hard copy and electronic format.

1.5 Manufacturer shall, if not maintaining the equipment, promptly notify Owner of any safety bulletins affecting said microprocessor-based control systems of which Owner or Owner's agent should take action.

1.6 Prior to final acceptance, Owner or Owner's representative reserve the right to accept or reject materials submitted in compliance of these paragraphs. Contractor shall have thirty (30) days to resubmit for approval, replacements for any items rejected.

1.7 A representative from SMU (Owner’s Representative) is the only person who can sign the final acceptance documents for the elevator from the installer/manufacturer.

2.0 Deliverables

2.1 Prior to final acceptance of the completed elevator system, the Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments and/or programmable software changes on any unit of microprocessor-based elevator control equipment installed by the Contractor. Any such tools shall become the property of the Owner.

2.1.1 If any diagnostic tools provided to the Owner require periodic re-calibration and/or re-initialization, the Contractor shall perform such tasks on a timely basis at no additional charge to the Owner for as long as the elevator control system is in operation, regardless of who is maintaining the system. If the tools cannot be re-calibrated on site, provide "loaner" tools at no charge to ensure that the system always remains serviceable.

2.2 Contractor shall deliver to the Owner, printed or on-line "adjustor-level" help instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, adjustments and/or programmable software changes on any unit of microprocessor-based elevator control equipment installed by the Contractor. Accompanying these instructions shall be any and all access codes,
passwords, nomenclature or other proprietary information that is necessary to interface the tool with the microprocessor control equipment.

2.4 Contractor shall provide any tools or copies of software (to be retained on SMU property) that are required for complete and comprehensive repair, troubleshooting and maintenance of the unit(s).

2.4 Contractor shall provide a list or manual of all applicable parts and spare parts.
SECTION 14240

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Hydraulic passenger elevator as shown and specified. Elevator work includes:
1. Commercial, hydraulic elevators; passenger.
2. Elevator car enclosures, hoistway entrances and signal equipment.
4. Operation and control systems.
5. Accessibility provisions for physically disabled persons.
6. Equipment, machines, controls, pit ladders, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
1. Division 3 Sections: Installing inserts, sleeves and anchors in concrete.
2. Division 5 Sections:
   a. Providing hoist beams, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
   b. Grouting hoistway entrance sills and frames for passenger elevators.
      Providing structural steel door frames with extensions to beam above if required on hoistway sides and sills for freight elevators, including finish painting.
3. Division 9 Sections: Providing passenger elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
4. Division 15 Sections:
   a. Sump pit and pump.
   b. Heating and ventilating hoistways and machine rooms.
5. Division 16 Sections:
   a. Providing electrical service to elevators, including fused disconnect switches.
   b. Emergency power supply, transfer switch and auxiliary contacts.
   c. Heat and smoke sensing devices.
   d. Convenience outlets and illumination in machine room, hoistway and pit.

1.2 SUBMITTALS

A. Product data: When requested, submit product data for the following:
1. Elevator car enclosures and hoistway entrances.
2. Operation, control, and signal systems.

B. Shop drawings:
1. Show equipment arrangement in the machine room, pit and hoistway. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Color selection: Submit color charts of exposed finishes and materials for color selection.
   1. When requested, submit samples of exposed finishes and materials selected for the elevator system materials and components.

D. Certificates: Inspection and acceptance certificates of elevator system installation.

E. Operation and maintenance data. Include the following:
   1. Operation and maintenance instructions.
   2. Parts list, with recommended parts inventory.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer regularly engaged in manufacturing, installing, and servicing elevators of the type required for the project.
   1. The manufacturer of the machine, controller, signal fixtures, door operators cab, entrances, and all other major parts of the elevator operating equipment.
      a. The major parts of the elevator equipment shall be manufactured in the United States, and not be an assembled system.
   2. The manufacturer shall have a documented, on-going quality assurance program.

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than five years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
   1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
   5. Texas Accessibility Standards (TAS).
   6. Texas Department of Licensing and Regulation, Elevator Division.

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware and operation shall comply with ASTM E152, UL 10B and NFPA Standard 80. Provide entrance assembly units bearing UL Class B labels or equivalent.

E. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   1. Arrange for inspections and make required tests.
   2. Deliver to the Owner upon completion and acceptance of elevator work.
1.4 DELIVERY, STORAGE AND HANDLING
   
   A. Deliver elevator materials, components and equipment in manufacturer's protective packaging.
   
   B. Store materials in a dry protected area provided by others. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage, soiling, or deterioration.

1.5 PROJECT CONDITIONS
   
   A. Painting:
      1. Except as otherwise specified, paint all metal work provided by the elevator manufacturer and installer.
      2. Provide all ferrous metals installed in the hoistway shop primed with a rust inhibitive primer.

1.6 WARRANTY
   
   A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months from date of Substantial Completion.

1.7 MAINTENANCE
   
   A. Furnish maintenance and call back service for a period of 12 months for each elevator from date of Substantial Completion. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation.
      1. Maintenance work, including 24 hour-per-day, 7 day-per-week emergency call back repair service, shall be performed by trained employees of the elevator contractor.
      2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
      3. Manufacturer shall have a service office and full time service personnel within a 75 mile radius of the project site.

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:
      1. Thyssenkrupp.
      2. Otis.

2.2 MATERIALS, GENERAL
   
   A. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.
B. Steel:
2. Sheet: ASTM A 366, cold-rolled steel sheet, commercial quality, Class 1, matte finish, stretcher leveled.

C. Stainless steel:
1. Shapes and bars: ASTM A 276, Type 304 (18-8).
2. Tubing: ASTM A 269, Type 304 (18-8).

D. Bronze:

E. Aluminum:
2. Extrusions: ASTM B 221, alloy 6063-T52.


2.3 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a suitable subfloor. Underside of the platform shall be fireproofed.

B. Sling: Steel stiles affixed to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega and tee shaped, fastened to the building with steel brackets.

D. Guide Shoes: Slide guides shall be mounted on top and bottom of the car.

E. Guide Rail Lubricators: Provide a leakproof reservoir on top of upper guide shoes. Wool felt wiper shall apply an even, uniform flow of lubricant which shall thoroughly cover face of guide rail.

F. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

G. Jack: Jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Jack unit shall consist of the following components:
1. Heavy seamless steel tubing plunger accurately turned and polished.
2. Stop ring shall be electrically welded to the plunger to prevent plunger leaving the cylinder.
3. Internal guide bearing.
4. Packing or seal of suitable design and quality.
5. Drip ring around cylinder top.
6. Cylinder made of steel pipe and provided with a pipe connection and air bleeder.
7. Weld brackets to the jack cylinder for supporting the elevator on pit channels. An auxiliary safety bulkhead shall be provided in the lower end of the cylinder.
8. Provide HDPE cylinder protection to protect the cylinder from corrosion and to contain any oil in the event of a cylinder leak.

H. Automatic Terminal Limits: Place electric limit switches in the hoistway near the terminal landings. Limit switches shall be designed to cut off the electric current and stop the car if it runs beyond either terminal landing.

I. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

J. Failure Protection: Design electrical control circuit so if a malfunction occurs, due to motor starter failure, oil becoming low in the system, or the car failing to reach a landing in the up direction within a pre-determined time, the elevator car will automatically descend to the lowest terminal landing. If power operated doors are used, the doors will automatically open when the car reaches that landing to allow passengers to depart. The doors will then automatically close and all control buttons, except the "door open" button in the car station, shall be made inoperative.

K. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary pipe and fittings shall connect the power unit to the jack unit. Provide proper grade oil.

L. Emergency Terminal Stopping Device: Provide emergency terminal stopping devices for speeds over 100 FPM. The emergency terminal stopping device shall operate independently of the normal terminal stopping device if it fails to slow down the car at the terminal as intended. Stopping devices shall not be prevented from functioning by a single short circuit caused by a combination of grounds or by other conditions.

1. Normal and emergency terminal stopping devices shall not control the same controller switches unless two or more separate and independent switches are furnished, two or which shall be closed in either direction of travel to complete the circuit to the control valve solenoids in the down direction and to complete the circuit to the pump motor for the up direction of travel.

M. Pit Ladder: Furnished and installed by elevator contractor.

2.4 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:
1. Oil reservoir with tank cover and controller compartment with cover.
2. An oil hydraulic pump.
3. An electric motor.
4. Oil control unit with the following components built into single housing: high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and magnetic controller.
B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Drive: Drive shall be by direct coupling with the pump and motor submerged in the oil reservoir or by multiple V-belts and sheaves of number and size to insure maximum factor of safety. Drive type shall be determined based primarily on the load on the car, travel, and speed.

D. Motor: Premium efficiency inverter rated manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall comply with specified speeds and loads.

E. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
   1. Relief valve shall be externally adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
   2. Up start and stop valve shall be externally adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
   3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
   4. Lowering valve and leveling valve shall be externally adjustable for drop-away speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling when slowdown is initiated.

F. Power controller shall contain electrical contactors, electro-mechanical switches and thermal overload relays. Mount components in a NEMA 1 enclosure. Logic control system shall be microprocessor based and protected from environmental extremes and excessive vibrations.

G. Reduced Voltage Starting: Provide a solid state starter to limit current inrush during starting and to provide gradual acceleration of the motor. Motor starting shall not be initiated by mechanical contacts. Starter shall include a current limit adjustment range of 200 percent to 450 percent of the overload adjustment range. Provide an integral fault detection and diagnostic system.

2.5 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening.
   1. Manufacturer's standard entrance design, bearing Underwriters' Laboratories "B" labels, and consisting of 14 gauge frames with 2 inch profile, 16 gauge doors, hangers, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
2. Elevator wall interface with hoistway entrance assembly shall comply with elevator manufacturer's requirements.
   a. Stainless Steel, No. 4 satin finish.
   a. Stainless Steel, No. 4 satin finish.

B. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable slide to accommodate the up-thrust of the doors.
   3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

C. Hoistway Sills: Extruded, with grooved surface, 1/4 inch thickness.
   1. Aluminum.

2.6 CAR ENCLOSURE (Refer to paragraph 3.8 of this section for cab finishes):

A. Car Enclosures:
   1. Walls: Cab type DAP-R, reinforced 16 gauge cold-rolled steel with two coats factory applied baked enamel finish.
   2. Canopy: Reinforced 14 gauge cold-rolled steel with hinged exit. Finish: Two coats factory applied reflective baked enamel.
   3. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.
      a. Cab Sills: Extruded, with grooved surface, 1/4 inch thickness.
         1) Aluminum.
   4. Ventilation: Two speed exhaust fan mounted on the car top.
   5. Pad Buttons: Provide pad buttons on cab front(s) and walls.
      a. Provide one set of vinyl protection pads.

2.7 DOOR OPERATION

A. Door Operation: Provide a direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. Direct drive geared operators, AC controlled units with oil checks, or other deviations are not acceptable.
   1. No Un-Necessary Door Operation: Car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as the next car up.
   2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel will reverse and the door will reopen to answer the other call.

4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door movement is obstructed for a field programmable time, a buzzer will sound and the doors will close at reduced speed. If the infra-red door protection system detects a person or object while closing, the doors will stop and resume closing after the obstruction has been removed.

5. Limited Door Reversal: If the doors are closing and an infra-red beam is interrupted, the doors will reverse and reopen partially. After the obstruction is cleared, the doors will begin to close.

6. Door Open Sentinel: If the doors are opening, but do not fully open after a field adjustable time, the doors will recycle closed then open six times to try and correct the fault.

7. Door Close Sentinel: If the doors are closing, but do not fully close after a field adjustable time, the doors will recycle open then close six times to try and correct the fault.

8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

2.8 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in bronze no. 4 integral swing return panel requiring no applied faceplate. The panel shall consist of a series of modules, inclined 20 degrees from vertical for optimum viewing and accessibility.

1. The lowest module shall contain the "door open," "door close," "alarm" buttons and a keyed "emergency stop" switch.

2. Intermediate modules shall contain floor buttons which illuminate when a call is registered and remain illuminated until the call is answered. Raised floor indications and handicap symbols shall be located immediately adjacent to the floor buttons and be fully integrated in the module design. No applied symbols or floor indications or symbols on the buttons shall be permitted.

3. The next module shall contain required switches.

4. The top module shall contain fire service features in accordance with ASME A17.1, Rule 211.3, including operating instructions.

5. Engrave fire service signage, capacity, and elevator number. No plastic inserts.

B. Position Indicator (Passenger): An electronic dot matrix position indicator inclined 20 degrees from vertical and mounted in a module matching the control panel for optimum viewing. As the car travels, its position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing.
C. Emergency Light: An emergency light and capacity plate shall be integrated into a module inclined 20 degrees from vertical. Emergency light shall illuminate automatically upon loss of the building's normal power supply.

D. Emergency Communications System: Provide an emergency communications device mounted in the swing return. Emergency communications device shall comply with the Texas Accessibility Standards (TAS).

E. Passenger elevator special accessories:
   1. Independent service switch.
   2. Inspection switch.
   3. Two speed fan/light switch.
   4. Hands free telephone.
   5. Second dedicated phone line for remote access monitoring systems.

2.9 CONTROL SYSTEMS

A. Controller: The elevator control system shall be microprocessor based and software oriented and be linked together for purposes of communication by a serial communications link. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
   1. Momentary pressing of one or more buttons shall dispatch the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed. Each landing call shall be canceled when answered.
   2. When the car is traveling in the up direction, it shall stop at all floors for which car buttons or "up" hall buttons have been pressed. The car shall not stop at floors where "down" buttons have been pressed, unless the stop for that floor has been registered by a car button or unless the down call is at the highest floor for which any buttons have been pressed. Pressing the "up" button when the car is traveling in the down direction shall not intercept the travel unless the stop for that floor has been registered by a car button or unless the up call is the lowest for which any button has been pressed.
   3. When the car has responded to its highest or lowest stop, and stops are registered for the opposite direction, its direction of travel shall reverse automatically and it shall then answer the calls registered for that direction. If both up and down calls are registered at an intermediate floor, only the call corresponding to the direction of car travel shall be canceled upon the stopping of the car at the landing.
   4. Provide group operations for multi-car groups.

B. Microprocessor: Locate the main microprocessor and car controller behind the elevator swing return panel.
   1. Microprocessor door operator shall reside in the door operator and control all functions of the elevator door(s).
   2. Microprocessor selector shall reside on the car top and contain hall effect transducers that detect magnetic fields. Locate the magnetic fields on a perforated metal tape that runs the length of the hoistway.
C. Provide a key operated switches in the elevator for the purpose of removing the car from normal operation and allowing the locking out of certain doors or floors from service. When the switches is in the "independent service" position, the elevator will bypass all landing calls and answer only car calls. The operator will have complete control over the operation of the car.

2.10 HALL STATIONS

A. Vandal Resistant Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction. Faceplates shall be stainless steel no. 4 satin finish.
   1. Each terminal station shall contain one illuminating push button.
   2. Each intermediate station shall consist of two illuminating pushbuttons, one for the up direction and one for the down position.
   3. Phase 1 firefighters service key switch, with engraved instructions, shall be incorporated into the hall station at the designated level.

B. Vandal Resistant Hall Position Indicator: A dot matrix position indicator shall be provided and inclined 20 degrees from vertical and mounted in a module for optimum viewing. As the car travels, its' position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing. When hall lanterns are provided, the position indicator shall be combined with the hall lanterns in the same faceplate.
   1. Hall Position Indicator: Located at main floor, combination hall lantern/position indicator.
   2. Hall lanterns @ all floors.
   3. Faceplates shall match hall stations.

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install an oil hydraulic silencer (muffler device) at the power unit location. Silencer shall contain pulsation absorbing material inserted in a blowout proof housing arranged for inspecting interior parts without removing unit from oil line. Rubber hose without blowout proof features will not be acceptable.

B. Vibration Pads: Mount vibration pads under the power unit assembly to isolate the unit from the building structure.

C. Sound Insulating Panels: When pump and motor are not submerged, provide panels manufactured of reinforced 14 gauge steel with 1 inch (25 mm) thick 1-1/2 pound fiberglass core attached to interior and mounted on all four open sides of the power unit frame.

D. Sound Isolating Couplings: When pump and motor are not submerged, install a minimum of two couplings in the oil line in the machine room between pump and jack.

PART 3 - EXECUTION
3.1 **EXAMINATION**

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and machine rooms, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 **INSTALLATION**

A. Install elevator systems components and coordinate installation of hoistway wall construction.

   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

D. Jack unit excavation: Drill or otherwise excavate below elevator pit construction as required to install the jack unit.

   1. Install casing for jack unit.
   2. Set casing for jack unit assembly plumb, and fill water-settled sand, eliminating voids.

E. Set jack unit-cylinder assembly plumb, centered accurately and shimmed to proper elevation, using centering lugs to prevent dislocation during filling. Fill space between casing and cylinder with clean, dry, compacted sand.

F. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn Parts. Comply with AWS standards for workmanship and for qualification of welding operators.

G. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

H. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
I. Sound isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent the transmission of vibrations to the structure, and eliminate sources of structure-borne noise from the elevator system.

J. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

K. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascias and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

L. Lubricate operating parts of system, including ropes, as recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.4 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.5 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

3.6 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.7 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in
normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.8 ELEVATOR SCHEDULE

A. Elevator Control Model – Substitutions are not acceptable
   • Motion Control Engineering (MCE)
   • Elevator Control Corporation (ECC)
   • Smartrise
   • Galaxy

1. Cab Finish:
   a. Stainless Steel Wall Panels: Manufacturer's standard stainless steel wall panels.
   b. Entrance Columns/Returns/Headers: 14 gauge stainless steel, Type 302, No. 4 brushed finish.
   c. Doors: 18 gauge stainless steel, No. 4 brushed finish.
   d. Ceiling: Suspended stainless steel, No. 4 satin finish with LED lighting. (Island style) controlled with occupancy sensor.
   e. Flooring: By others. (Elevator contractor to prepare floor to receive selected finish). Ensure COP will clear installed floor.
   f. Handrails: Provide manufacturer's 4" bar, stainless steel, No. 4 brushed finish handrails.
   g. Car Operation Panel: Hall Lanterns and Hall push buttons; stainless steel No. 4 brushed finish.

2. Rated Capacity: 2,500 to 4,500 lbs. capacity. Job specific.
3. Rated Speed: 100 to 125 ft/min.
4. Travel: approximately 46'-0" or job specific.
5. Openings: 2 to 4 openings or job specific.
   a. Front opening only: Center or side opening operations.
6. Clear Car Inside: 5'-8" wide x 7'-9-1/2" deep.
7. Cab Height: Nominal 9'-0".
8. Hoistway Entrance Size: 8'-0" high x 3'-6" wide.
11. Pit Equipment: as required by code.
12. Jack assembly: borehole or holeless type.
13. Special Features: MUST MEET ALL CURRENT CODE REQUIREMENTS
   a. Oil viscosity control
   b. Muffler
   c. Electronic Safety Edge

END OF SECTION 14240
SECTION 13905
FIRE SPRINKLER

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. General

1. Work covered under this section includes furnishing of material, labor, and equipment to install a fire protection system as indicated on Drawings and specified herein which may include one or all of the following:
   b. A complete Type I standpipe system as defined by NFPA 14.
   c. A complete fire pump installation with pressure maintenance pump as defined by NFPA 20.

2. Provide all piping, valves, sprinklers, alarm devices, fire department connections, fire pump and controller (if required), pressure maintenance pump and controller, and any other material necessary to provide a complete fire protection system to protect the specified building areas in accordance with design requirements. Include incidental work necessary to make the fire system complete, satisfactory, and ready for operation.

3. Each item of equipment shall be capable of performing its function over an extended period of time with a minimum of attention and maintenance. All equipment shall be constructed using new materials designed and built in accordance with the best practices of the industry. Each item of equipment shall be listed on the Underwriters Laboratories (UL) Fire Protection Equipment List and Factory Mutual (FM) Approval Guide. Each major item of equipment shall bear the manufacturer's name or trademark; serial number; and UL and FM label.

4. The equipment manufacturer and installer of the sprinkler and standpipe system shall have been engaged in the sprinkler industry for a minimum of five (5) years. The equipment manufacturer and installer of the fire pump installation shall have been engaged in the fire pump industry for a minimum of five (5) years.

5. Work to be performed under direct supervision of a Professional Engineer, registered in the State of Texas.

B. Design Requirements:

1. System requirements and pipe sizes shall be determined using hydraulic calculations prepared in accordance with NFPA 13.

2. System requirements are to comply with applicable NFPA Standards (as referenced by the Authority Having Jurisdiction).

1.2 REGULATORY AGENCIES

A. All requirements of State of Texas, the Office of the State Fire Marshal, the University’s Insurance Carrier, and the City of University Park Fire Marshal shall apply to the specifications and design requirements, including the following:

2. Underwriters Laboratories Inc. (UL), Fire Protection equipment list.
3. Factory Mutual Approval Guide.
4. Occupational Safety and Health Act.
5. NFPA 13 - Standard for the Installation of Sprinkler Systems
7. NFPA 13R - Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.
15. NFPA 231 - General Storage.
17. NFPA 1963 - Fire Hose Connections.
19. City of University Park Building Codes (Current version).
20. SMU Office of Risk Management.

B. Installation shall comply with the following:
1. Building and fire safety codes of the Authority Having Jurisdiction.
2. Owner’s insurance carrier.
3. Owner’s Fire Safety Division, a part of the Office of Risk Management.
4. National Fire Protection Association (NFPA) Standards (as referenced by the Authority Having Jurisdiction and the Owner’s insurance carrier).
8. Design documents.

C. Building and Fire Safety Code, NFPA Codes, and Design Documents are subject to interpretation by the following:
1. Local Fire Protection Bureau.
2. State Fire Marshal.
3. Health and Building Departments.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s specifications and technical data including performance, construction, and fabrication.
1. The Contractor shall submit a complete list of material and equipment for approval before purchase or installation. The list of material and equipment shall describe type of material, capacities, manufacturer, and catalog numbers of equipment and give such information as necessary for checking equipment for approval.
B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, including specific requirements indicated.

1. Submit shop drawings on the following items:

C. The Contractor shall submit detailed shop drawings prepared in accordance with NFPA 13, NFPA 14 and NFPA 20 for approval for all equipment to be constructed and installed.

Such shop drawings shall be complete, giving all required information, and shall be properly checked and coordinated with the work of other trades before submission.

1. Unless otherwise noted, prepare shop drawings in accordance with requirements for “Working Plans” as described in NFPA Standard 13.
2. Certify Shop Drawings by a Professional Engineer registered in the State of Texas.
3. Draw floor plans at 1/8” - 1.0’ scale or greater.
4. Calculations of Hydraulically Design Systems:
   a. Calculations are required for hydraulically designed fire protection systems.
   b. Unless otherwise noted, prepared calculations in accordance with requirements of “Hydraulic Calculations Procedures” as described in NFPA Standard 13.
   c. Include calculations with submission of Shop Drawings.

D. Calculations for hydraulic design shall be made in accordance with NFPA 13.

Calculations shall comply with the project WSSC hydraulic data sheet and be submitted for approval. Verify water supply data with the Office of Facilities Planning and Management (Facilities) base calculations on the given fire flow. Data shall indicate which hydrant was flowed and which device was read for static and residual pressure. Different hydrants shall be used for the gauging and flowing tests. The engineer shall provide the Facilities record data at the point of the new utility connection as follows:

1. Building Name (SMU Hydrant #XXX):
2. Elevation XX feet, Static XX psi, Residual XX psi,
3. Flow XXXX GPM.

E. Quality Control: Field Quality Control submittals, as specified in Part 3 of this document.

1. Document results of tests, required by the Authority Having Jurisdiction, the Owner’s insurance carrier, and listed NFPA Standards
2. Document test results on standard NFPA forms or a form acceptable to the Architect/Engineer.
3. Contractor’s Material and Test Certificates (CMTC) shall be provided to the Project Manager assigned to the installation, upon completion of the entire system covered by these specifications. After the certificates have been received, final inspection of the work will be made by the SMU - Facilities. Test certificates will in no way relieve the Contractor from completing all contract work or the terms of his guarantee.

F. Submittal Sequence

1. Submit sets of shop drawings to each of the following agencies, send copy of transmittal to the Architect/Engineer:
   a. City of University Park Fire Marshal
   b. The City Fire Marshal needs three (3) copies, two (2) of which will be returned as approved
   c. SMU Office of Risk Management – Fire Safety Division
Note: The Owner's Insurance Carrier should be notified when drawings are available and the actual drawing should be available for viewing at a location on campus.

2. After obtaining approval from Authorities Having Jurisdiction, submit shop drawings to Architect/Engineer for review.

3. Contractor shall submit for approval to all applicable regulatory agencies and SMU-Facilities all the listed submittals in items 1.04 A, B, & C above of all systems and equipment.

4. No work shall be performed, unless performed at the Contractor's own risk, until the shop drawings, calculations and list of materials have been approved.

5. As-builts drawings: All deviations from the approved shop drawings require prior approval of the owner, SMU-Facilities, architect, and engineer. Before acceptance testing shall begin, as-built drawings of the completed fire protection system shall be supplied to the SMU PM who will forward to the Office of Risk Management.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Not less than five- (5) years experience in the actual production of the specified products.

B. Installer’s Qualifications: Firm with not less than five (5) years experience in the installation of systems similar in complexity to those required for this project, including specific requirements indicated.
   1. A qualified installer who is experienced in installation and alteration of fire protection systems.
   2. Provide evidence of successful completion of not less than five (5) projects of equal size and complexity.
   3. Certify that each welder has passed AWS qualification tests for welding processes involved and that certifications are current.
   4. Any “hot work” projects must comply with SMU Hot Work Procedures.

Note: Hot work includes, but is not limited to work involving welding, cutting, brazing, soldering, grinding, or any other operations which involve open flames or produces smoke, sparks or heat.

1.5 COORDINATION

A. Coordination with Construction Documents:
   1. Refer to Drawings for smoke and fire ratings of walls and floors.
   2. Refer to Drawings for exact locations and mounting height of cabinets housing fire department valves.
   3. Contact the City of University Park Fire Department to insure hose connections are compatible with hoses used by the agency responding to fires.
   4. Refer to Reflected Ceiling Plans unless otherwise noted for suggested location of sprinklers.

B. Coordination with Civil Documents:
   1. Refer to Civil utility plans for location of fire protection water service.
1.6 SPECIAL WARRANTIES
1. Contractor/manufacturer/installer shall warrant installed system for a period of two years from Date of Substantial Completion against the conditions indicated below. When notified in writing from the Owner, they shall promptly and without inconvenience and cost to the Owner correct said deficiencies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Note: List products by name and manufacturer. All products used must be listed in UL Fire Protection Equipment Directory and FM Approved Guide and conform to requirements contained in Contract Documents.

A. Acceptable Manufacturers:
1. [______________].
2. [______________].
3. [______________].

2.2 PIPING PRODUCTS

A. General:
1. Galvanized pipe and fittings should be used. SMU’s representative must approve any deviation from galvanized pipe. Stainless steel, copper, and CPVC, e.g. Blazemaster, piping and fittings are also acceptable.
2. Only pipe and fitting materials listed in this specification shall be acceptable for use. Extra lightweight steel, products, and associated fittings are not acceptable.
3. Provide and install all piping, approved shop drawings and hydraulic calculations in accordance with all the applicable standards.
4. Connection shall be made to the SMU on-site water system. The connection between system piping and underground piping shall be made with a cast iron flanged piece, properly fastened.
5. Piping shall run concealed in areas with drop ceilings.
6. Installation of all piping shall be in coordination with duct, light fixture, and any other work that may obstruct sprinklers.
7. All piping exposed installed outside, or otherwise exposed to weather shall be externally galvanized or stainless steel.

B. Related Standards:
1. Pipe manufacturing standards:
2. Fitting manufacturing standards:
   a. Cast iron threaded fittings, Class 125 pound and 250 pound - comply with ANSI (American National Standards Institute) B16.4
   b. Malleable iron threaded fittings, Class 150 pound and 300 pound - comply with ANSI B16.3.
   c. Cast iron-flanged fittings, Class 125 pound and 250 pound - comply with ANSI B16.1.
   d. Butt welded fittings - comply with ANSI B16.9.
e. Flange gaskets - comply with ANSI B16.24
f. Fastener bolts - comply with ANSI B18.2.1.
g. Fastener nuts - comply with ANSI B18.2.2.

C. Galvanized Steel:
1. One (1) inch through six (6) inches; Schedule 40.
2. Eight (8) inches through twelve (12); Schedule 30.

D. Threaded Fittings:
1. Cast iron, galvanized, 125 pounds:
   a. 1” through 2” 300 psi
   b. 2-1/2” through 12” 175 psi
2. Cast iron, galvanized, 250 pounds - 400-psi maximum working pressure.
3. Malleable iron, galvanized, 150 pounds - 300-psi maximum working pressure.
4. Malleable iron, galvanized, 300 pounds”
   a. 1” through 2” 1500 psi
   b. 2-1/2” through 4” 1000 psi
   c. 5” and 6” 800 psi

E. Flanges and Flanged Fittings:
1. Cast iron, galvanized, 125 pounds; 175 psi maximum working pressure.
2. Cast iron, galvanized, 250 pounds; 400 psi maximum working pressure.
3. Flange gaskets; 1/16 inch thick.
4. Bolts and nuts; Bolt length to allow not less than 1.8 inch exposed thread beyond nut.

F. Grooved Couplings: Pressures shown are maximum working pressures.
1. Only FM and UL approved manufacturers can be used for Schedule 40 pipe with cut grooves:
2. Grooved couplings to be galvanized when located in exterior positions or in parking garages.

G. Grooved Fittings:
1. For connection to cut or rolled grooved pipe.
2. Pressure rating of fittings to exceed maximum system working pressure.
3. Only FM and UL approved manufacturers can be used
4. Galvanized fittings shall be used when located in parking garages or exterior locations.

H. Bolt-on Fittings:
1. Mechanical Tees with clamp-on outlet.
2. Only FM and UL approved manufacturers can be used

2.3 PIPE SUPPORTS

A. Only FM and UL approved materials can be used.

B. Design: Provide in this section in compliance with Section 15140 and NFPA 13 (as referenced by the Authority Having Jurisdiction).
1. All hanger assemblies shall be listed by UL. No sprinkler piping is to be supported from any mechanical or electrical devices and/or equipment (ducts, lights, etc.). No chains, wire or perforated band iron will be permitted for hangers. Hanger assemblies installed outside or inside shall be galvanized. Hanger assemblies used for copper tubing shall provide dielectric protection for the contacting tubing.

C. Support Types:
1. Band Type Hanger Rings
2. Clevis Type Hanger Rings
3. Riser Clamps
4. Upper Hanger Attachments
5. Concrete Expansion Shields
6. Explosive Driven Studs
7. Pipe Stands

All of the above should be galvanized, or better.

2.4 PIPE SLEEVES

A. Design Requirements:
1. Galvanized steel pipe; Schedule 40 minimum wall thickness
2. Inside diameter is to be not less than 1 inch larger than outside diameter of pipe passing through it.

B. Install galvanized steel pipe sleeves of ample diameter at all points where pipes cut beams or floors or walls, so sized and installed that sprinkler pipes will not bend.
1. Install sleeve before walls or concrete work is built or poured, with sleeves being flush with wall surfaces.
2. Sleeves for underground pipes shall be caulked with oakum and molten lead and be watertight.

C. Floor, wall and ceiling plates shall be pressed steel or cast iron split plates, chromium plated.

D. All escutcheons shall be of the proper type for the model of sprinkler installed.

2.5 FIRE STOPPING

A. Acceptable Manufacturers: Only FM and UL approved materials can be used.

2.6 GENERAL PURPOSE VALVES

A. Acceptable Manufacturers: Only FM and UL approved materials can be used.

B. General Requirements: UL Listed - 175 psi working pressure
1. All valves on connections to water supply to sprinklers shall be UL and FM listed butterfly type indicating valves except as noted.
2. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained within a NEMA Type 1 general-purpose indoor rated housing. Either unauthorized removal of the switch housing (when the valve is open) or closing the valve, will cause the switch contacts to
change position. The switch shall have four conductors to accommodate connections to Style 4 or Style 6 signaling line circuit devices.

3. Post Indicator Valve (PIV) - when indicated on the contract drawings, a gate valve on incoming water service shall be operable by a UL and FM listed post indicator valve with tamper switch. Post indicator valve shall be installed a minimum of 40 feet from the building. Post indicator valves are only required where the sprinkler system water supply travels through the facility before it reaches the main control valve.

4. All valves controlling water supply for sprinklers shall be readily accessible for use by emergency and maintenance personnel.

5. All valves controlling water supply for sprinklers shall be supervised by the fire alarm system.

6. All valves controlling water supply for sprinklers shall be locked per SMU Risk Management procedures at the completion of the project.

C. O S & Y Valves

1. General Requirements:

SMU prefers that butterfly valves be used in lieu of OS&Y or other gate valves wherever allowed by code.

2. Where O.S. & Y indicating valves are installed, the following shall apply:

   a. Indicator Control Valve (O S & Y Gate Valve): Rising indicating stem, screwed ends. One (1) inch through two (2) inches.

      1) Valves 2 inches and smaller shall be UL listed brass body and brass stem seat. Valves shall be suitable for 175 psi working pressure.

   b. Indicating Control Valve (O S & Y Gate Valve): Rising indicating stem, flanged ends. Two and one half (2-1/2) inches through twelve (12) inches.

      1) Valves 2-1/2 inches and larger shall be UL listed iron body except seats, discs, and stems which shall be brass. Valves shall be suitable for 175 psi working pressure.

D. Wall Post Indicating Control Valve: Non-rising stem gate valves with flanged ends. Four (4) inches though twelve (12) inches.

E. Indicating Control Valve (Butterfly Valve): One (1) inch through two and one half (2-1/2) inches. Bronze body with screwed ends with stainless steel disk and stem.

F. Indicating Control Valve (Butterfly Valve): Ductile iron, lug, or wafer type body with stainless steel stem and gear operator. Two (2) inches through twelve (12) inches.

G. Globe and Ball Valve: Bronze body with screwed ends.

   1. Globe valves shall be of cast bronze construction in accordance with ASTM B-62 specifications 85-5-5-5 for superior corrosion resistance. The hand wheel shall be manufactured from cast iron materials to comply with the American Water Works Association C-509 and ASTM A-126 class B standards. Valves shall be suitable for 175 psi working pressure.

   2. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl covered handle.

H. Check Valve

1. Acceptable Manufacturers:
a. Grinnell/Gem  
b. Reliable  
c. Star Sprinkler Corp.  
d. The Viking Corp.

2. A alarm check valve approved by FM and UL with all the required trim shall be installed as indicated on the contract drawings. All equipment shall be located and installed so that it is accessible for inspection, removal, and repair and shall be substantially supported.

3. A retarding device shall be installed with valves provided to permit repair or removal without shutting off the water supply to sprinklers. Valves shall be arranged so that they are sealed in the open position. A valve and bypass line shall be installed in order to test the alarm devices at the alarm check valve. All valves shall be identified with appropriate signs. All drainage shall be arranged to the main drain.

4. An outside electric gong with guard, approved by FM and UL shall be provided. The electric gong shall be located at the fire department connection. The electric gong shall be provided with a standard sign stating "SPRINKLER FIRE ALARM - CALL THE FIRE DEPARTMENT".

5. An approved check valve with automatic drip shall be installed on each fire department connection line. The check valve shall be located near as practicable to the point where it joins the system. No other type valve shall be installed in the fire department connection line.
   a. Check Valve: Bronze body with screwed ends. One (1) inch through two (2) inches.
      1) Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted. Valves shall be suitable for 175 psi working pressure.
   b. Rubber Face Check Valve: Swing type with flanged ends. Two and one half (2-1/2) inches through twelve (12) inches.
      1) Check valves shall comply with the following:
      2) Check valves 2-1/2 inches and larger shall be UL listed iron body swing check with cast brass hinge, rod, and brass faced discs. Valves shall be suitable for 175 psi working pressure.
   c. Flanged or Grooved End Swing Type Check Valve:
   d. Detector Check Valve: Flanged end; four (4) inches through ten (10). Check valve with bypass assembly consisting of shut off valves, swing check, and flow meter.
      1) Acceptable manufacturers: Only materials approved by FM and UL.
   e. Detector Double Check Valve Backflow Prevention Assembly: Two independent spring loading poppet-type check valve assemblies mounted in a common body. Two gate valves and four test cocks. Bypass consisting of double check valve assembly, shut-off valves, testcocks, and a low flow accurate meter.
      1) Acceptable manufacturers: Only FM and UL approved materials can be used.
   f. Double Check Valve Backflow Prevention Assembly: Two independent spring loading poppet-type check valve assemblies mounted in a common body. Two gate valves and four test cocks.
      1) Acceptable manufacturers: Only FM and UL approved materials can be used.
2.7 FIRE PROTECTION VALVES

A. Acceptable Manufacturers:
   1. Reliable
   2. The Viking Corp.
   3. Tyco
   4. Victaulic

B. Wet-pipe Alarm Valve: Flanged, grooved, or screwed ends.
   1. Hand hole: large enough to remove clapper and seat.
   2. Trim includes drains, gauges, valves, and retard chamber.

2.8 ALARMS (FOR EXTERIOR USE)

A. Water Motor Alarm
   1. Design Requirements:
      a. Delrin Impeller
      b. Corrosion resistant metal cover
      c. Working pressure of 175 psi
      d. Exterior surface painted with red enamel

B. Acceptable manufacturers: Only FM and UL approved materials can be used.

2.9 SUPERVISORY DEVICES

A. Acceptable Manufacturers: Only FM and UL approved materials can be used.

B. Supervisory (Tamper) Switches
   1. Design Requirements
      a. Switches to indicate position of control valve
      b. Rated for 120 VAC - 12 VDC
      c. Compatible for use with the designated fire alarm system

C. Waterflow Switches:
1. Paddle type for pipe sizes one and one quarter (1-1/4) inches through two (2) inches:
   a. Rated for 175 psi working pressure
   b. Two sets 120 VAC - 12 VDC form C contacts
   c. Compatible for use with the designated fire alarm system
2. Paddle type for pipe sizes two (2) inches through eight (8) inches with 0 - 70 second adjustable pneumatic retard.
   a. Rated for 175 psi working pressure
   b. Two sets 120 VAC - 12 VDC form C contacts
   c. Compatible for use with the designated fire alarm system

2.10 SYSTEM ACCESSORIES

A. Where required for access to equipment, and where not otherwise specified, metal access doors and frame shall be furnished. Panels shall be suitable for surface in which installed, where applicable.
B. Furnish and install on each control valve identification tags indicating the portion of the system controlled by each valve.
   1. Tags shall be brass with black enamel number and lettering to indicate use, securely fastened to valve wheel with brass chain.
   2. Provide an approved valve chart in frame and glass cover showing location and use of each valve. Chart shall be made on tracing, printed, and set in frame. The chart shall be hung in a visible location near the alarm check valve.
C. Pressure Gauges: Gauges should have a three and one half (3-1/2) inch dial marked in five (5) pound increments - measuring 0 - 300 psi with:
   1. Threaded to one quarter (1/4) inch ANPT (American National Pipe Thread)
   2. Working pressure of 175 psi
   3. Approved by both UL and FM for fire protection service
   4. Acceptable Manufacturers: Only FM and UL approved materials can be used.
D. Automatic Ball Drips: ½ inch or ¾ inch ANPT
   1. Acceptable manufacturers: Only FM and UL approved materials can be used.
E. Insert Sight Glasses: Working pressure of 175 psi.
   1. Acceptable manufacturers:
      a. Manufacturer of fire protection valve

2.11 FIRE DEPARTMENT CONNECTIONS

A. Each fire department connection shall be the flush type. Free standing type fire department connections shall only be installed when approved by SMU-Facilities and shall be located a minimum of 40 feet from the building. Each fire department connection shall have two (2) 2-1/2 inch inlets with threads conforming to the American National Fire Hose Connection Screw Thread as defined in NFPA 1963, equipped with UL listed screw caps with pin lugs and chains. The fire department connection shall be labeled "AUTOMATIC SPRINKLER" with raised letters at least one inch in size cast on plate. The fire department connections shall be not less than two feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets. Two fire department connections are required when two or more risers are provided.
B. Acceptable Manufacturers: Only FM and UL approved materials can be used.

C. Design Requirements:
1. UL Listed
2. Threads to conform to local fire department standards
3. Escutcheon lettered as indicated on Drawings
4. Plugs and chains
5. Pin lug hose thread swivels
6. Double clapper
7. Size to be two and one half (2-1/2) inches by four (4) inches, unless noted otherwise
8. Chrome plate or Stainless Steel finish

D. Type 1: Wall Mounted Flush Type

2.12 SPRINKLERS AND ACCESSORIES

A. Acceptable Manufacturers: Only FM and UL approved materials can be used.
1. Reliable
2. The Viking Corp.
3. Tyco

B. General:
1. Minimum sprinkler orifice size shall be ½ inch. Sprinklers shall ordinarily be 1/2-inch orifice with 165 °F Temperature ratings unless another type is required and approved in writing by SMU-Facilities.
2. Unless noted otherwise, sprinklers in non-public spaces such as mechanical/electrical equipment and storage rooms shall have a brass finish. All other exposed sprinklers shall have chrome plated or specified manufacturers decorator finish. All escutcheons shall be of the proper type for the model of sprinkler installed.

C. Sprinklers shall be FM approved and only new sprinklers shall be used. Any sprinkler that incurs damage, is painted, or is sprayed with any fire retardant or obstructive material shall be replaced at no cost to the Owner. Sprinkler installation shall be properly coordinated with other work including duct and electric fixture installation. The correct type of sprinkler head shall be used in every location.

D. Sprinklers that may be subject to mechanical or other damage due to their location (under stairwells, low hanging sprinklers in corridors, storage rooms, under ducts, sports facilities, etc.) shall be provided with Sprinkguard type head protectors.

E. Sprinklers under open grating shall be provided with approved shields.

NOTE: Concealed sprinklers shall only be used in areas where adequate headroom is not provided or are specifically requested by the architect and approved by the owner.

F. Sprinkler Guards: Sprinkguard style with white finish.

G. Spare Sprinkler Cabinet: Wall Mounted - Storage capacity of not less than 12 sprinklers for each major (common) type must be provided and installed.
H. Spare Sprinkler Heads: Not less than twelve (12) sprinklers for each major (common) type must be provided.

I. Sprinkler Wrench: To match style and brand of sprinklers used must be provided.

J. Spare Escutcheons: At least six (6) of each type of escutcheon used in the building must be provided.

2.13 IDENTIFICATION SIGNS

A. Identification signs shall be porcelain enameled 18-gauge steel (Reliable Model A identification signs or equivalent) and shall be affixed securely by brass chain to all valves. The signs shall be red in color.

B. The main drain sign shall be labeled "MAIN DRAIN". Riser drains shall be labeled "RISER DRAIN" or "DRAIN". Riser room shall be labeled for identification via the closes public corridor.

C. Auxiliary drain signs shall be labeled "AUXILIARY DRAIN".

D. Inspector's Test signs shall be labeled "INSPECTOR'S TEST".

E. All water supply control valves shall have a standard sign identifying the portion of the system controlled, noting that the valve must be kept open, and leaving a blank space for notification information.

F. All valves which are placed in concealed spaces shall have the standard sign affixed in a visible location (valves hidden by a drop ceiling shall have the sign mounted on the ceiling or wall under the valve).

2.14 DRAINS AND TEST PIPING

A. All risers, including the alarm check valve, shall be equipped with drains with sizes as specified in NFPA 13. The alarm check valve drain ("main drain") shall be piped to the outside of the building at a point free from causing water damage. Where this arrangement is not practical, the drain shall be piped to a floor drain or sump approved for the purpose by the Facilities

B. Every waterflow switch shall have an inspector's test connection piped in accordance with item 2.10C of this specification.

C. All drains and test piping shall be piped to the outside of the building at a point free from causing water damage. Where this arrangement is not practical, the drain shall be piped to a floor drain or sump approved for the purpose by the Facilities.

2.15 DRY PIPE SYSTEM

A. Dry systems shall only be installed when adequate heat or insulation can not be provided to prevent sprinkler piping from freezing.

B. In order to standardize fire suppression equipment on campus, the installation of water based fire protection systems shall be limited to the following manufacturers:
1. Reliable
2. The Viking Corp.
3. Victaulic
4. Tyco

C. A dry pipe valve that is FM and UL approved shall be used with all the required trim shall be installed for protection of unheated areas. All equipment shall be located in a heated area and installed so that the equipment is accessible and shall be substantially supported.

D. An air compressor that is FM and UL approved with an automatic air maintenance device shall be installed and sized in accordance with NFPA 13. A cycling type refrigerated compressed air dryer shall be provided with the air compressor(s).

E. Pressure switches shall be installed to monitor dry-pipe system water flow, low air pressure and high air pressure.

F. A separate test connection shall be provided in accordance with NFPA 13 to test the dry-pipe system alarms.

G. An accelerator, when required by NFPA 13, shall be Reliable Model B1 or equivalent.

NOTE: Only galvanized pipe shall be used for the installation of this type of system. When galvanized still pipe is used in dry pipe systems, the use of Nitrogen or similar inert gas must also be used to prevent accelerated corrosion damage.

2.16 PRE-ACTION SYSTEM

A. Pre-action systems shall only be installed where required by SMU - Facilities and the facility program.

B. In order to standardize fire suppression equipment on campus, the installation of water based fire protection systems shall be limited to the following manufacturers:
   1. Reliable
   2. The Viking Corp.
   3. Tyco
   4. Victaulic

C. The following pre-action valves, with all required trim, shall be installed:
   1. 4 inch or larger: Only materials that are FM and UL approved shall be used for type of system.
   2. 2-1/2 inch: Only materials that are FM and UL approved shall be used for type of system.
   3. An air compressor with an air maintenance device that is FM and UL approved shall be provided for maintenance and supervision air pressure. A cycling type refrigerated compressed air dryer shall be included.

D. The pre-action valve shall be activated by rate compensated heat detectors or cross-zoned smoke detection as approved SMU - Facilities.

NOTE: Only galvanized pipe shall be used for the installation of this type of system.
2.17 **FIRE PUMP, MOTOR AND CONTROLLER**

A. A fire pump shall only be installed when the existing water supply is not adequate to meet the required sprinkler demand and building height.

B. The pump furnished for fire protection service shall be supplied with the specified driver, controller and pump accessory items by the pump manufacturer.

C. The pump and controller shall be listed by UL and FM approved for fire protection service. The standard manufactured product of Aurora, ITT A-C Pump, Patterson, and Peerless is recommended.

D. The fire pump shall be capable of delivering not less than 150% of the rated flow at not less than 65% rated head. The shut off (no flow) head shall not exceed 120% of rated head.

E. The fire pump shall be a horizontal split case, single stage, centrifugal pump specifically labeled for fire service. Limited service fire pump controllers will not be accepted unless specified by SMU - Facilities.

F. The pump and motor shall be mounted on a common baseplate of formed steel.

G. The pump and motor shall be checked for alignment after the pump base has been installed and grouted in place.

H. The pump casing shall be cast iron with 6 inch 125 pound rating suction and 6 inch 250 pound rating discharge flanges machined to American National Standards Institute (ANSI) dimensions.

I. The pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump's maximum diameter impeller plus the maximum allowable suction head, but in no case less than 250 psi.

J. **Electric Motor**
   1. The pump driver shall be horizontal, foot mounted, ball bearing induction motor with horsepower rated for the required pump, 3 phase, 60 hertz with open drip-proof NEMA enclosure.
   2. The motor shall be mounted on a steel base common to the pump and shall be connected to the pump with a flexible coupling protected by a suitable guard.
   3. The fire pump manufacturer shall accurately align the pump and motor shafts prior to shipment. After field installation, but prior to grouting the base, a millwright or similarly qualified person check and verify or correct the shaft alignment.

K. **Fittings**
   1. The pump manufacturer shall furnish piping accessory items for the pump installation, which will adapt the pump connections to the fire protection system and test connection as follows. Fittings subjected to pump discharge pressure shall be ANSI 250-psi rating. Fittings subjected to suction pressure shall be 125-psi rating.
   2. Eccentric tapered suction reducer
   3. Concentric tapered discharge increaser
4. Hose valve test header (as required by NFPA 20)
5. Hose valves with caps and chains
6. Pump casing relief valve (shall be piped to drain in accordance with item 2.10C of this specifications).
7. Automatic air release valve
8. Ball drip valve
9. Suction and discharge pressure gauges

L. Flow Meter

M. An FM approved flow meter shall be provided and installed in accordance with NFPA 20 to test the pump, when required by code.

N. Fire Pump Controller
1. The main fire pump controller shall be a factory assembled, wired, and tested unit.
2. The controller shall be UL listed and FM approved for fire pump service. The standard manufactured product of Firetrol, Joslyn Clark, Metron, or equivalent shall be provided.
3. The controller shall be rated for the motor specified in item 2.13.J of this specification.
4. The controller shall be of the combined manual and automatic type designed for across-the-line type starting.
5. The minimum withstand rating of the controller shall not be less than 30,000 Amps RMS Symmetrical at 480 volts.
6. The controller shall include a motor rated combination isolating disconnect switch/circuit breaker, mechanically interlocked and operated with a single externally mounted handle. When moving the handle from "OFF" to "ON" the interlocking mechanism shall sequence the isolating disconnect switch "ON" first and then the circuit breaker. When the handle is moved from "ON" to "OFF" the interlocking mechanism shall sequence the circuit breaker open first, and then the isolating disconnect switch.
7. The controller shall have externally mounted, individual, visible indicators for "Power Available", "Phase Failure", "Phase Reversal", "Pump Running", and "Run Time On".
8. The controller shall be supplied with a pressure switch with a range of 0-300 psi and have independent high and low pressure settings. The pressure switch shall be mounted inside the controller. The piping connection for the pressure switch shall be installed as shown in NFPA 20 Appendix A. The pressure switch set points shall be set as shown in NFPA 20 Appendix A.
9. The controller shall have manual shutoff.
10. Individual "Phase Failure", "Phase Reversal" and "Pump Operating" alarm contacts shall be wired for connection to the Main Fire Alarm Control Panel, and the CCMS.
11. The manufacturer shall test the entire controller assembly prior to shipment. This test shall include each function the controller may be required to perform. The manufacturer shall test the circuit breaker at 300% full load, 600% full load, and short circuit current settings. The manufacturer shall perform a high potential test of the controller power circuits at not less than two times the rated voltage plus 1000 Volts. Documentation of the above listed tests shall be submitted before the fire pump acceptance test.
O. Field Acceptance Test
1. A field acceptance test shall be conducted upon completion of the pump installation. All acceptance testing outlined in NFPA 20 shall be conducted by the installing contractor in the presence of a representative of the SMU - Facilities. Documentation of all factory and field tests shall be submitted at the conclusion of the field acceptance test. Failure to submit documentation of the factory and field tests will be just cause for equipment rejection.

P. Fire Pump Test Discharge Manifold
1. The discharge manifold for fire pump testing shall be sized in accordance with NFPA code and remotely located from the building it serves. This manifold shall be chrome plated, galvanized, or otherwise constructed in accord with owner’s direction. It shall be located such that discharging water will not damage adjacent landscape, plantings, structures, etc. A building mounted discharge manifold shall not be used.

2.18 PRESSURE MAINTENANCE PUMP, MOTOR CONTROLLER

A. The contractor shall furnish and install a pressure maintenance pump with a rated capacity of 10 GPM, against a total head of 250 feet coupled to a motor rated for the required pump, not to exceed 5 HP (Maximum), 480 volts, HZ, 3 phase.

B. Pump shall have cast iron diffusers and adapter with registered fits to maintain axial alignment; bronze enclosed impellers, bronze casing rings, bronze base bearing; steel clamp type shaft coupling; stainless steel shaft. Impellers shall be pinned to shaft to prevent damage due to reverse rotation and to maintain proper interstage lateral setting. Suction and discharge connections to be of the threaded NPT type. Pump shall be designed for and equipped with mechanical seal type stuffing box. Vent tap is to be provided for stuffing box to relieve entrapped air. Pump shall be provided with cast iron base with drain plug.

C. The pressure maintenance pump shall be installed in accordance with NFPA 20.

D. The control valves to and from the pressure maintenance pump shall be supervised butterfly valves installed in accordance with item 2.02.A of this specification.

E. Pressure maintenance Pump Controller
1. The pressure maintenance pump controller shall be factory assembled, wired and tested, and specifically designed for this type of service.
2. The pressure maintenance pump controller shall be listed by UL.
3. The pressure switch shall have a range of 0-300 psi and have independent high and low pressure settings. The pressure switch shall be mounted inside the controller. The piping connection for the pressure switch shall be installed as shown in NFPA 20 Appendix A. The pressure switch set points shall be set as shown in NFPA 20 Appendix A.
4. The controller shall have a running period timer to be set to keep the motor in operation for at least one minute.
5. The controller manufacturer, prior to shipment, shall hook up and test the pressure maintenance pump controller as a completed assembly. This test shall include each function the controller may be required to perform. The manufacturer shall perform a high potential test of the controller power circuits are not less than two times the
rated voltage plus 1000 volts. Documentation of the above listed tests shall be submitted prior to the pump acceptance test.

F. Field Acceptance Test
   1. A field acceptance test of the pressure maintenance pump and controller shall be performed by the contractor at the same time as the main fire pump acceptance test. The acceptance test shall include each function the controller may be required to perform including manual start-stop, automatic start-stop, and minimum run timing.

2.19 RISERS
   A. Each standpipe riser shall be installed with a UL listed 2 1/2-inch NST fire department hose valves with screw caps on each floor in an accessible, protected and readily visible location.
   B. Fire suppression riser pipes shall be hung from the deck above in lieu of supported from the floor (using pipe clamps).

2.20 DRY STANDPIPE SYSTEM
   A. Dry standpipe systems shall be the manual-dry type as defined by NFPA 14.
   B. Each standpipe riser shall be installed with a UL listed 2-1/2 inch NST fire department hose valves with screw caps on each floor in an accessible, protected, and readily visible location in accordance with NFPA 14.
   C. Each dry standpipe riser shall have a drain sized and located in accordance with NFPA 14. Each drain shall be piped outside the building in accordance with item 2.10.B of this section.
   D. All dry piping shall be installed so that the entire system may be drained. The number of auxiliary drains shall be kept to a minimum.
   E. All dry piping, hangers and fittings shall be galvanized.
   F. Each dry standpipe shall be provided with an air and vacuum valve installed at the top of each riser. The air and vacuum valve shall be a 1-inch APCO Series 140 air and vacuum valve, manufactured by Valve and Primer Corporation or approved equal.

2.21 BACKFLOW PREVENTION DEVICES/ASSEMBLIES
   A. Backflow prevention devices are required on all fire sprinkler systems by the City of University Park.
   B. All water flow calculations for the system must take the pressure loss due to the installation of such a device into consideration when calculating the system requirements.

PART 3 - EXECUTION
3.1 GENERAL

A. Sprinkler system shall be furnished with a spare sprinkler cabinet, wrench, and 12 spare sprinklers of each type and rating as are in the building.

B. A complete care and maintenance catalog is to be furnished at the valve location, enclosed in a watertight container, and attached to the riser. Verbal instructions for operation, care and maintenance of the sprinkler installation are to be given to the Owner's maintenance representative by the Contractor's representative upon completion and/or activation of the system.

C. Protection: All exposed piping devices (non-brass and chrome) are to be painted with two coats of bright red paint. Painting to conform to the protective coating section of the specifications.

3.2 INSTALLATION

A. Install Fire Protection System in compliance with applicable NFPA standards (as referenced by the Authority Having Jurisdiction).

B. Pipe and Fittings:
   1. Acceptable pipe connection methods:
      a. Schedule 40 and 30 - cut grooves or threaded
   2. Acceptable pipe size reducers:
      a. Reducing fittings
      b. Tapered reducers
   3. Compression flanges or reducing grooved couplings are acceptable.
   4. Install piping as follows, unless noted otherwise:
      a. Parallel to walls
      b. Above suspended ceiling
      c. Behind walls
      d. Concealed

C. Pipe Supports:
   1. Install hangers in compliance with construction documents and NFPA 13 (as referenced by the Authority Having Jurisdiction).

D. Pipe Sleeves and Seals:
   1. Sleeve fire rated walls
      a. Firestop in accordance with manufacturers instructions to obtain same rating as the wall.
   2. Sleeves in walls must be flush on finished sides of the walls.

E. Drains: Provide drainage facilities a follows:
   1. In accordance with NFPA standards, and as indicated
   2. Drain entire system by gravity
   3. Drain size not less than ¾ inch
   4. Provide nipple and cap or brass plug for systems or partial systems of five (5) gallons or less.
   5. Provide valve and plug for systems or partial systems of more than five (5) gallons.
F. Control Valves:
   1. Provide tamper switches for valves controlling water supply to sprinkle system.
   2. Bolt position on lugged butterfly valves to allow removal of downstream piping.
   3. Limit pressure reducing valves to 150 psi outlet pressure
   4. Globe or ball valves to be used as shutoff valves for:
      a. Water piping systems
      b. Drain valves
      c. Test valves

G. Alarms: Install water motor alarm as follows:
   1. Above fire department Siamese connection
   2. Not less than eight (8) feet above the finished grade.

H. Supervisory Devices:
   1. Provide supervisor (tamper) switch for each control valve.
   2. Provide water flow switch for each wet pipe system and where otherwise indicated.
   3. Provide water pressure supervisory switch as required by valve manufacturer. Lock
      all water control valves per SMU Risk Management and University insurer.

I. Fire Department Connections:
   1. Install Fire Department Connection not less than eighteen (18) inches and not more
      than four (4) feet above adjacent grade.

J. Sprinklers:
   1. Install sprinklers in fittings after piping is in place.
   2. Install exposed sprinklers with frame parallel to branch line.
   3. Install sprinkler guards where sprinklers are within seven (7) feet of the floor, or
      when subject to injury.
   4. Line sprinklers up with themselves.
   5. Locate sprinklers two (2) inches from center of ceiling tile.
   6. Install escutcheon flush with ceiling.

K. Signs: Provide permanent signs to identify:
   1. Drains
   2. Test connections
   3. Shut-off valves
   4. Each alarm
   5. Riser Room

L. Power Wiring: Furnished and installed under electrical section

3.3 FIELD QUALITY CONTROL

A. Arrange, conduct, and document all performance and acceptance tests required by the
   applicable NFPA Standards and the Authority Having Jurisdiction.
   1. Give sufficient advance notice of time of test
   2. Test must be witnessed by:
      a. Owner’s representative
      b. Authorized inspector of local jurisdiction
      c. Authorized State Inspector
      d. Owner’s insurance agent
3. Deficiencies to be corrected at no additional cost to owner.
4. Use new pipe and fittings as necessary to correct leaks.
5. Temporary repairs of leaks are not acceptable.
6. Repair water damage caused by leaks or test procedures.

B. Conduct test prior to:
   1. Painting
   2. Covering
   3. Concealing in any way

C. Pressure test control valves as follows:
   1. While under full system pressure,
   2. Open and close each valve.
   3. Demonstrate proper operation to owner

D. Test drain valves and test valves as follows:
   1. Open to full flow for two minutes
   2. Close to test for tightness

3.4 TESTING

A. A Contractor’s Material and Test Certificate (CMTC) shall be provided to the owner.

B. In addition to any tests, which might be required by the approving authorities, the entire sprinkler system (both wet and dry) shall be hydrostatically tested in accordance with NFPA 13. All dry system piping shall also be air tested in accordance with NFPA 13. All underground piping shall be hydrostatically tested in accordance with NFPA 24. Flow tests shall be performed at each test connection to test all alarm devices.

C. If leaks develop, they shall be repaired at the Contractor's expense.

D. Leaks developing from misaligned fittings or dull threads will be repaired by replacing the fittings.

E. Underground main and lead-in connections to the system risers shall be flushed in accordance with NFPA 13.

F. Dry-pipe system shall be tested in accordance with the requirements for testing dry-pipe systems in NFPA 13. Additionally, water shall be delivered to the inspector’s test connection within sixty (60) seconds after opening the valve.

G. The fire pump shall be tested in accordance with the requirements for acceptance testing in NFPA 20.

H. All testing listed above shall be performed by the installing Contractor in the presence of a representative of SMU – Facilities and SMU Risk Management.

3.5 APPROVALS

A. All work under this heading shall be installed in accordance with NFPA 13 and NFPA 20 and subject to the approval and inspection of the SMU - Facilities.
B. Upon completion of the entire system covered by these specifications, all test certificates required by all regulatory jurisdictions shall be completed and provided to SMU - Facilities by the Contractor. After the certificates have been received, final inspection of the work will be made by the SMU - Facilities. Test certificates will in no way relieve the Contractor from completing all contract work or the terms of his guarantee.

3.6 GUARANTEE

A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the date of final acceptance by the Architect, ordinary wear and tear excepted. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

3.7 QUALIFICATIONS

A. System design and installation shall be supervised by an experienced sprinkler system technician or fire protection engineer ten (10) years; experience with sprinkler systems. Shop drawings shall be prepared and signed by a NICET Level III or IV certified engineering technician or a registered fire protection engineer. The signature of the technician or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming with applicable state codes and recognized engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

3.8 MANUALS

A. Four (4) copies of the manufacturers' operating manuals and maintenance manuals shall be supplied to the University within fifteen (15) days of substantial completion.

3.9 CLEANING AND FLUSHING

A. Procedure:
1. Clean and flush piping systems and connections in accordance with the applicable NFPA Standards and the Authority Having Jurisdiction.
2. Connect hoses to outlets and discharge to sewer.
3. Discharged water must be free of rust, stain, and discoloration.
4. Remove stains caused by discharge.
5. Replace equipment and materials that cannot be cleaned.
6. Provide hoses and hose connections for this work.

END OF SECTION 13935
PART 1 - GENERAL

1.1 SUMMARY
   A. The design guidelines contained herein include the requirements for the furnishing, assembly, construction, installation, connection, and testing of a complete fire alarm system or portions thereof.

1.2 RELATED WORK
   A. All related work shall be properly coordinated with the design and installation of the fire alarm system including the following:
      B. Fire protection systems (sprinkler systems, standpipe systems, & fire pump installations).
      C. Wet chemical extinguishing systems.
      D. Mechanical systems (heating, ventilation, and air conditioning (HVAC) systems, smoke control systems, and smoke dampers).
      E. Emergency power systems.
      F. Security systems.
      G. Elevator installation. See the State of Texas Elevator Code.
      H. Central Control and Monitoring System (CCMS) in the SMU Police Department.

1.3 REQUIREMENTS
   A. The latest editions to the following codes and standards shall apply as a minimum but not be all-inclusive to the design and installation of fire alarm systems:
      B. City of University Park Fire Prevention Code
      D. City of University Park Building Code
      E. BOCA National Fire Prevention Code
      F. NFPA 70 - National Electrical Code
      G. NFPA 72 - National Fire Alarm Code
H. NFPA 80 - Fire Doors and Windows
I. NFPA 90A - Standard for Air Conditioning and Ventilating Systems
K. NFPA 170 - Fire Safety Symbols
L. ANSI/ASME A17.1 -- Safety Code For Elevators and Escalators as adopted by the City of University Park and the State of Texas
M. Americans with Disabilities Act (ADA)

1.4 SYSTEM DESCRIPTION
A. All new fire alarm and detection systems shall be analog/addressable systems. SMU has selected Edwards Technology as the campus wide alarm system. The panel selected is the EST-3.
B. All activating devices must be of the Edwards Signature type or must be compatible with the EST-3 System.
C. The system and components shall be the product of a single manufacturer of established reputation and experience. Installation shall include all parts, labor, software, programming, and hardware necessary to effect the installation in a competent and workmanlike fashion.

1.5 QUALITY ASSURANCE
A. The system and all components shall be listed by Underwriters Laboratory (UL) for fire protective signaling service (local and remote station, emergency communication and relocation equipment, and protective signaling systems) under UL 864. Automatic detectors, manual stations, sprinkler system alarm attachments, control unit accessories, notification appliances, and all other alarm system attachments shall be listed and approved for use with the specified control equipment.
B. Equipment Not Described: The installing Contractor is responsible for furnishing all material, equipment, and labor required to affect proper system operation.
C. Manufacturer/Distributor Support: The Contractor shall confirm to the satisfaction of the Southern Methodist University Office of Facilities Planning and Management (Facilities) that a factory authorized support organization exists within close proximity to the site. Such organization shall be adequately stocked with equipment, parts, and accessories, and adequately trained, and capable to perform all required engineering, maintenance, and testing support necessary to ensure continued efficient and effective system operation.
D. The University Electrical Engineer, the City of University Park Fire Marshal, and the SMU Fire Safety Division must approve the project, design, and installation in the Office of Risk Management.
1.6 SUBMITTALS

A. Shop drawing and product data approval shall be obtained from Facilities for all new fire alarm systems. The following items shall be submitted and approved before work may begin:

B. Shop Drawings: Shop drawings shall include the following:
   1. A building floor plan indicating the location of all system devices and components. Only fire alarm system devices will be permitted on these floor plan drawings.
   2. A wiring riser diagram.
   3. A panel wiring diagram.
   4. Device wiring details.
   5. Annunciator panel diagram.
   6. An address listing for each device.
   7. Wire sizes and types of wiring.
   8. Sequence of operation.
   9. Drawings shall clearly indicate the height and location of all equipment, devices, wiring, conduit, and junction boxes. All drawing symbols shall comply with NFPA 170.
   10. Submit shop drawings on the following items:

C. The Contractor shall submit detailed shop drawings prepared in accordance with NFPA 72 for approval for all equipment to be constructed and installed. Such shop drawings shall be complete, giving all required information, and shall be properly checked and coordinated with the work of other trades before submission.
   1. Unless otherwise noted, prepare shop drawings in accordance with requirements for “Working Plans” as described in NFPA Standard 72.
   2. Certify Shop Drawings by a Professional Engineer registered in the State of Texas or an individual with NICET III or IV Certification.
   3. Draw floor plans at 1/8” - 1.0’ scale or greater.

D. Installation Instructions: The following Manufacture guides shall be submitted:
   1. Installation guide.
   2. Programming guide.

E. Product Data: Manufacturer’s specifications and technical data including performance, construction, and fabrication.
   1. The Contractor shall submit a complete list of material and equipment for approval before purchase or installation. The list of material and equipment shall describe type of material, capacities, manufacturer, and catalog numbers of equipment and give such information as necessary for checking equipment for approval.

F. Sequence of Operation: A sequence of operation for each device type shall be submitted.

G. Address Listing: An address listing shall be provided indicating the address number and the custom

H. Address for each device in the system.

I. Battery Calculations: Battery calculations for stand-by power shall be submitted.
J. Submittal Sequence

1. Submit sets of shop drawings to each of the following agencies, send copy of transmittal to the Architect/Engineer:
   a. City of University Park Fire Marshal
   b. The City Fire Marshal needs three (3) copies, two (2) of which will be returned as approved
   c. SMU Office of Risk Management

Note: The Owner’s Insurance Carrier should be notified when drawings are available and the actual drawing should be available for viewing at a location on campus.

2. After obtaining approval from Authorities Having Jurisdiction, submit shop drawings to Architect/Engineer for review.
3. Contractor shall submit for approval to all applicable regulatory agencies and SMU-Facilities all the listed submittals.
4. No work shall be performed, unless performed at the Contractor's own risk, until the shop drawings, calculations and list of materials have been approved.
5. All deviations from the approved shop drawings require prior approval of the owner, the City of University Park Fire Marshal, SMU-Facilities, architect, and engineer. Before acceptance testing shall begin, as-built drawings of the completed fire protection system shall be supplied to the owner, the Project Manager, and SMU Office of Facilities Planning and Management.

1.7 SEQUENCE OF OPERATION

A. Manual Pull Station: Activation of any manual pull station shall automatically operate all audible and visual appliances and produce an alarm signal at the control unit and the remote annunciators. All manual pull station signals shall be automatically transmitted to SMU Police Department as an "Alarm" signal.

B. Smoke Detector: Activation of any smoke detector shall start the alarm verification mode. When the smoke detector latches into the alarm mode the fire alarm system shall automatically operate all audible and visual appliances and produce an alarm signal at the control unit and at the remote annunciators. All smoke detector alarm signals shall be automatically transmitted to SMU Police Department as an "Alarm" signal.

1. Elevator Recall - Smoke detectors at elevator landings, in elevator machine rooms, and in elevator shafts shall also recall the elevator(s) to the designated floor or to the designated alternate floor as required by the elevator safety code.
2. Door release - Smoke detectors used to shut smoke or fire doors shall release the detector's associated door. Smoke detectors used to shut a door in a fire-rated stair enclosure shall release all of the doors in the stair enclosure. Each smoke detector used for door release shall be provided with an alarm verification feature and shall indicate a supervisory signal only.
3. Suppression System Activation - Smoke detectors used to activate a fire suppression system (Pre-action sprinkler system, deluge system, or special extinguishing system) shall be crossed-zoned.

Cross zoning of detectors reduces the allowable spacing for the smoke detectors by 1/2.

4. Heat Detector: Activation of any heat detector shall automatically operate all audible and visual appliances and produce an alarm signal at the control unit and at the
remote annunciators. All heat detector alarm signals shall be automatically transmitted to SMU Police Department as an "Alarm" signal.

a. Elevator Shunt-trip - Heat detectors in elevator shafts, and in elevator machine rooms shall also operate the shunt trip circuit breaker for the elevator main line in accordance with the elevator safety code.

b. Suppression System Activation - Heat detectors may be used in conjunction with smoke detectors to activate a fire suppression system (Pre-action sprinkler system, deluge system, or special extinguishing system).

5. Water Flow Alarms: Activation of a water flow alarm shall automatically operate all audible and visual appliances and produce an alarm signal at the control unit and at the remote annunciators. Each individual water flow switch shall have a distinct address. All water flow alarm signals shall be automatically transmitted to SMU Police Department as a "Water Flow" signal.

6. Valve Tamper Switch: Activation of a valve tamper switch shall initiate a supervisory alarm at the system control panel. Each individual tamper switch shall have a distinct address. All valve tamper alarms shall be transmitted to SMU Police Department as a "Valve Tamper" signal.

7. Duct Smoke Detector: Activation of a duct smoke detector shall initiate a supervisory alarm at the system control panel. A duct smoke detector activation shall also initiate an air handling unit shutdown as required by NFPA 90A. Each individual duct smoke detector shall have a distinct address. All duct detector alarms shall be transmitted to SMU Police Department as a "Trouble" signal.

8. Fire Pump Supervisory Signals: In buildings with fire pumps, individual supervisory signals shall be provided for the following conditions:
   a. Fire pump running (if applicable)
   b. Fire pump loss of power in any phase (if applicable)
   c. Fire pump phase reversal (if applicable)

   Activation of a fire pump supervisory signal shall initiate a supervisory alarm at the system control panel. Each set of contacts in the fire pump controller shall have a distinct address. All fire pump supervisory signals shall be transmitted to SMU Police Department as a "Trouble" signal.

9. High/Low air pressure signals: Buildings with dry-pipe or pre-action sprinkler systems shall provide a supervisory signal for system high and low air pressure. Activation of a high/low air signal shall initiate a supervisory alarm at the system control panel and at the remote annunciators. Each pressure switch shall have a distinct address. All high/low air supervisory signals shall be transmitted to SMU Police Department as a "Trouble" signal.

10. Trouble Signals: Loss of primary power, low battery (secondary power), short circuit, open faults, ground faults, missing detectors, abnormal detector status (e.g.: dirty detector, replacement incompatible with the defined address), disabled devices and abnormal control functions shall initiate audible and visible trouble signals at the control unit and remote annunciators. Audible trouble signals shall sound until silenced. A textual message and a trouble LED shall continuously indicate silenced trouble signals until restored to normal operation. The trouble LED shall remain illuminated until all abnormal conditions are cleared. Upon a return to normal operation, the audible trouble signal shall resound until restored to normal position. Subsequent trouble events shall re-sound audible trouble signals until silenced. All trouble events shall automatically be transmitted to SMU Police Department as a "Trouble" signal.
PART 2 - PRODUCTS

All components used in any fire alarm system must be Y2K compliant.

2.1 CONTROL PANEL

A. The fire alarm and detection system shall be microprocessor based, power-limited, supervised, 24 VDC, non-coded system. The system shall be installed and configured to operate up to 128 devices in alarm simultaneously. An event history log of up to 500 alarm and trouble events shall be continuously maintained in non-volatile memory at the control unit. (The actual number of individual alarm and trouble events may be less than 500, provided the total combined number of alarms and troubles logged is at least 500.) The system shall be capable of providing the following functions:
1. Integral clock/calendar
2. Alarm verification (assigned by detector address)
3. Three-pulse temporal pattern evacuation signal
4. Functional walk-test of all initiating and signaling devices.

B. The control panel shall provide power, supervision, annunciation, and control of all detection and alarm devices. All external circuits shall be inherently power-limited as described in NFPA 70 Article 760. The control panel shall be of modular construction to permit expansion and modification of system functions. All modules and controls required to provide reliable operation as described in the drawings and specifications shall be provided. The status and sensitivity of analog devices shall be capable of being read, displayed, and adjusted at the control panel. The system shall be capable of responding to alarm conditions while in the maintenance, program, and test modes. Program or maintenance activities which bypass or disable system devices or functions shall be continuously monitored, displayed, and recorded in the event history log. When devices or functions are disabled or bypassed, a trouble or supervisory condition shall exist until the functions restored to "normal." The control unit shall individually identify addressable devices and addressable interface modules (monitor and control). Conventional devices shall be capable of being supported by addressable interface modules. The panel must be an Edwards Technology Systems - Model EST-3. All devices, unless otherwise specified must be Edwards Technology Systems devices.

C. Fire Alarm Annunciator: Textual annunciation shall be provided at the control unit and remotely in a location as approved by Facilities, SMU’s Fire Safety Division, and the City of University Park Fire Marshal. The textual display shall consist of an 80 character supertwist alphanumeric display, which shall include a 32 character user defined message for each device or function. Each of the following functions shall be continuously monitored: analog detector sensitivity, response, open faults, short-circuit faults, ground faults (+/-), functionality, and test. The annunciator shall be capable of displaying the status of each detector and occurrence of each state. Annunciator controls at each location shall include momentary contact switches for locate, next alarm, next trouble, display hold, acknowledge, signal silence, trouble silence, and system reset. Equivalent switch configurations providing the same functions are acceptable. LED’s shall be provided at each annunciator location to indicate system power (green), trouble (yellow), supervisory alarm (yellow), and alarm (red). The connection between the remote annunciator and the system control panel shall be electrically supervised.
D. Supervision: All initiating and notification appliances wiring shall be continuously supervised for proper operation. Abnormal conditions shall be reported at the control unit and remote annunciator within 90 seconds of occurrence. Style A (Class B) supervision of all initiation devices is required. Notification appliance wiring shall also be Style Y (Class B). The occurrence of a single open fault, single ground fault, and combination of single open and single ground faults shall not prevent more than half of the notification appliances to be inoperative. The removal or disabling of any initiating or notification appliance shall produce a trouble signal. Replacement of any analog initiating device with another device of another type, even with the same address, shall initiate a trouble signal.

E. Power Supply: Primary power shall consist of a two-wire 120 VAC branch circuit from the emergency power distribution panel. The branch circuit disconnect shall be arranged and protected to prevent inadvertent disconnection and ensure optimum reliability. Standby power consisting of rechargeable batteries shall be provided. Batteries shall be capable of powering the system in the normal (standby) mode for 24 hours followed by 5 minutes of operation in the alarm mode. In the normal mode, the system shall be capable of powering all simultaneously connected and operated loads in the alarm mode, including alarm speakers, strobe lights, detectors, and auxiliary devices. All circuit wiring (AC or DC) shall be separately fused within the control panel.
   1. Batteries: Provide sealed, maintenance-free, lead-calcium batteries as the source of emergency power. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power. Batteries shall have lead bolt-on terminals. Batteries with fast-tab terminals are unacceptable.
   2. Battery charger: Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged the charger shall recharge them back to 95% of full charge within 48 hours.

F. System Control: In the control mode, the system operator shall have the ability to arm or disarm system devices and control functions individually (by address). Analog detector sensitivity may also be adjusted in the control mode. Access to the control mode shall be restricted by security passwords.

G. Test Mode: The system shall permit functional tests of all initiating and notification appliances by a single individual remote from the control panel. The system shall maintain a log of this activity in the event history log of the last 500 events.

H. Programming: System functions shall be controlled using "AND," "OR," and "NOT" logic operators or commands. Timing and counting functions shall also be provided. System functions may be configured to operate on the basis of device count, zone count, time, and/or all panels should be programmed to automatically silence trouble conditions.

I. Passwords and Security: Access to control unit and remote annunciator switches wiring and power supplies shall be restricted by keyed-alike locks. Control function and programming access shall be limited by user defined passwords. Passwords shall be assigned by SMU Risk Management.
2.2 ALARM INITIATING DEVICES

Alarm initiating devices consist of conventional and analog detectors and manual stations connected to the system control unit via Style D or Style 6 (Class A) circuits. These devices shall be listed and approved for use with the control equipment specified.

A. Analog Smoke Detector - Ionization Type: Analog ionization smoke detectors shall be plug-in type with base. The detector base shall be of the twist/lock type with screw terminals for field wiring. Detectors shall be of the dual chamber type with solid state LED indicator lamp. The reference chamber shall compensate against atmospheric changes in temperature, humidity, and barometric pressure to prevent false or nuisance humidity and barometric pressure to prevent false or nuisance alarms. The sensing chamber shall be separated from the atmosphere by an approved dust and insect screen, which will not prevent products of combustion from entering. Detector sensitivity shall be capable of being read and adjusted remotely from the control panel. Sensitivity readings shall be time integrated to provide trouble indication when detector sensitivity is affected by accumulations of dust in the detection chamber or detector aging. System software shall maintain the detector in operation by adjusting the sensitivity range when dirt or other conditions affecting sensitivity develop over a substantial period of time.

B. Analog Smoke Detector - Photoelectric: Analog photoelectric smoke detectors shall be plug-in type with base. The detector base shall be of the twist/lock type with screw terminals for field wiring. Analog photoelectric detectors shall use a long-life LED as their light source and a photodiode as their receiver. An automatic gain control circuit shall be provided to compensate for detector aging and dirt accumulation and maintain the detector within the correct sensitivity range. Detector supervision shall include supervision of detector optics. Light source failure or a critical reduction of light output caused by dirt accumulation shall initiate a trouble signal. Detector sensitivity shall be capable of being read and adjusted from the control panel.

C. Interface Modules (Monitor): Interface modules shall be mounted in standard 4" x 4" square or octagonal electrical boxes with flush-mount covers. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamp shall be visible in the cover. Connections between devices and modules shall be integrally supervised for open and ground faults.

D. Interface Modules (Control): Interface modules shall be mounted in standard 4" x 4" square or octagonal electrical boxes with flush-mount covers. Each module shall be located within three feet of the device being controlled. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamp shall be visible in the cover. Interface modules shall be equipped with form "C" dry-contacts rated 2A 125 VAC or 2A 30 VDC resistive.

E. Duct Smoke Detector Assemblies: Duct smoke detector assemblies shall consist of an analog duct detector (ionization or photoelectric) and an air duct sampling assembly with sampling tube and detector housing. Each concealed duct smoke detector shall be provided with a remote alarm lamp and keyed test switch located in a visible and accessible location.

F. Addressable Manual Station: Manual stations shall be red in color, coded, double-action type mounted in a semi-flush backbox. Manual station covers shall be hinged and secured with a lockset. Lockset shall be keyed the same as the control unit lockset. Manual pull
stations installed in areas subject to damage, vandalism, and/or false alarms shall be protected by a STI Stopper II as manufactured by Safety Technology International, Inc.

G. Addressable Heat Detectors: Addressable heat detectors shall be plug-in type with base. The detector base shall be of the twist lock type with screw terminals for field wiring. Heat detectors shall be of the rate compensated type.

Note: Heat detectors, not smoke detectors, should be used in all electrical rooms, machine rooms, and attics.

H. If a building is sprinklered, smoke detectors should only be used in common areas and other areas specifically addressed by code (i.e., top of stairwells, top of elevator shafts, above fire panel, etc.).

2.3 NOTIFICATION APPLIANCES

Alarm indicating appliances shall consist of audible and visual signals for public signaling of fire. An STI Fire Alarm Signal Damage Stopper as manufactured by Safety Technology International, Inc shall protect all indicating appliances subject to damage and/or vandalism.

A. Horn/Strobe Signals: Horn/strobes shall be semi-flush mounted with red covers and white strobe lens with red lettering. The word "FIRE" shall be stenciled on the strobe lens. Strobe signals shall comply with the ADA.

B. Strobe Signals: Strobe units shall consist of a red cover and white lens with red lettering. The word "FIRE" shall be stenciled on lens in red lettering. Strobe signals shall comply with the ADA.

C. Speaker/Strobe Signals: Speaker/Strobe Signals shall be used with voice/alarm systems. Speaker/Strobe Signals shall be semi-flush mounted with red covers and white strobe lens with red lettering. The word "FIRE" shall be stenciled on the strobe lens. Strobe signals shall comply with the ADA.

2.4 AUXILIARY DEVICES

A. Magnetic door holders shall be used to hold fire or smoke doors in the open position during normal operation. Upon activation of smoke detectors located immediately adjacent to the door opening, the door holders shall release, allowing the doors to close automatically. Detectors initiating this function shall be located and installed in accordance with NFPA 80. Door holders shall be listed and approved for the intended use, and connected to the control panel by an addressable interface module (control).

PART 3 - EXECUTION

3.1 QUALIFICATIONS

A. An experienced fire alarm technician or Fire Protection Engineer shall supervise system design and installation with not less than five years experience with fire alarm systems. Shop drawings shall be prepared and signed by a NICET Level III or IV certified engineering technician or a Registered Fire Protection Engineer. The signature of the
A technician or Engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming to applicable state codes and recognized engineering practices. A NICET Level II or III fire alarm system technician shall continuously supervise all field installation work.

3.2 FIRE ALARM CONTROL PANEL (FACP)

A. LOCATION: The FACP shall be located in:
1. An area close to the main entrance of the building.
2. An area agreed upon by both the Division of Fire Safety in the Office of Risk Management and Environmental Health & Safety and the City of University Park Fire Marshal.

B. LOCKSET: The lockset for the FACP shall be keyed for a CAT-45.

C. BATTERY BOX: Auxiliary batteries shall be stored in a battery box located adjacent to the FACP. The lockset for the battery box shall be keyed the same as the FACP.

3.3 ANNUNCIATOR PANEL

A. Annunciator panels shall be located at the main entrance to the building, in a public area such as a lobby, and in plain view unobstructed by the opening of doors or other parts of the building. The lockset to gain access to the annunciator panel shall be keyed the same as for the FACP. Annunciator panels with reset functions that are not key activated shall be provided in a tamper proof locked cover to prevent unauthorized tampering.

3.4 INITIATING DEVICES

A. Manual Pull Stations: Manual pull stations shall be provided at the following locations:
1. At the exit from each floor at the stair enclosure exits on the corridor or room side located not more than 5 feet from the stair door.
2. At each door opening to the exterior of the building, except for retrofit application when the minimum number of pull stations stipulated by code may be used.
3. At the exit from each High-Hazard Occupancy (High-Hazard as defined by NFPA 101).
4. Manual pull stations shall be located in accordance with NFPA 72.
5. At each exit from an Assembly Occupancy (Assembly Occupancy as defined by NFPA 101).
7. All pull stations must be keyed to the CAT-45 keyway.
8. All pull stations that are accessible to the general public shall be covered with a “Stopper II” alarm cover.

Manual pull stations shall be installed in accordance with ADA requirements. All manual pull stations shall be located to be readily accessible, unobstructed, and visible.

B. Smoke Detectors: Analog smoke detectors shall be installed in accordance with NFPA 72 at the following locations:
1. At each elevator lobby as required by the elevator safety code where the elevator has fire recall.
2. In each elevator machine room if building is unsprinklered, as required by the elevator safety code.
3. At the top of each sprinkled elevator shaft and bottom of each sprinkled elevator shaft as required by the elevator safety code.
4. At the top of each stairwell.
5. At un-enclosed vertical openings as required by NFPA 101.
6. At atriums for smoke removal systems as required by NFPA 101.
7. High-value and high-risk areas such as art galleries, archival record storage, musical instrument storage rooms, library stack areas, and computer rooms.
8. At doors with magnetic hold-open devices.
9. For activation of a pre-action sprinkler system and other special fire suppression systems.
10. In all fire pump rooms.
11. At each FACP (Fire Alarm Control Panel).
12. In buildings that are fully sprinklered, smoke detectors will be restricted to corridors and hallways and not placed into individual offices unless specifically specified. The Fire Safety Division of Risk Management and Environmental Health & Safety and the University Electrical Engineer must be notified in advance of any changes in this specification.

All smoke detectors shall be programmed for a 30-second alarm verification cycle.

C. Duct Smoke Detectors: Duct smoke detectors shall be provided for mechanical unit shutdown as required by NFPA 90A.

D. Heat Detectors: Heat detectors shall be provided in accordance with NFPA 72 at the following locations:
1. In all sprinkled elevator machine rooms within two feet of the sprinkler head as required by the elevator safety code.
2. At the top of each sprinkled elevator shaft and bottom of each sprinkled elevator shaft within two feet of the sprinkler head as required by the elevator safety code.
3. In any unsprinklered storage room, mechanical room and electrical room.
4. In laundry rooms.
5. As required for activation of a pre-action sprinkler system and other special fire extinguishing systems.

E. Interface Modules (Monitor): Addressable interface modules shall be provided to monitor any conventional (non-addressable) alarm notification device. Such as:
1. Non-addressable heat detectors.
2. Non-addressable smoke detectors.
3. Valve tamper switches, and sprinkler system butterfly valves.
5. Pressure switches.
6. Fire pump supervisory alarms.

F. Interface Modules (Control): Addressable interface modules shall be provided within three feet of the device being controlled for the control of auxiliary functions such as:
1. HVAC Shutdown: of respective air handler upon activation of associated duct smoke detector.
2. Door Holders: release doors automatically upon activation of associated smoke detector.
3. Door Lock Release: unlock all doors with special locking arrangements as required by NFPA 101.
4. Elevator recall: recall elevators as required by the elevator safety code.
5. Elevator Shunt Trip: operate the shunt trip circuit breaker for the elevator main line in accordance with the requirements of the elevator safety code.

G. Water Flow Detectors: Water flow detectors shall be provided to monitor sprinkler systems for waterflow. Water flow detectors shall be provided for the following:
   1. At each alarm check valve (Pressure switch).
   2. At each dry-pipe valve (Pressure switch).
   3. At each pre-action system valve (Pressure switch).
   4. At each sprinkler or standpipe system riser.
   5. One flow switch per sprinkler system zone on each floor.

See the UMCP design guidelines for sprinkler and standpipe system for more specific information on water flow detectors.

H. Sprinkler/Standpipe Valves: Provide supervision for each sprinkler/standpipe system control valve.

I. Fire Pump Supervision: For each fire pump provide individual supervision of the following fire pump alarms:
   1. Fire pump running.
   2. Fire pump loss of power in any phase.
   3. Fire pump phase reversal.

J. High/Low Air Pressure Supervision: Provide supervision of low and high air pressure for each dry-pipe system and each pre-action system.

3.5 NOTIFICATION DEVICES

A. Horn/Strobe Signals: Provide combination horn/strobe signals throughout as required to ensure audibility and intelligibility of signal as detailed in NFPA 72.

B. Strobe Signals: Provide additional non-textual visual appliance throughout building to ensure compliance with ADA requirements.

C. Speaker/Strobe Signals: For all voice/alarm systems provide combination speaker/strobe signals throughout as required to ensure audibility and intelligibility of signal as detailed in NFPA 72.

3.6 OFF-SITE SUPERVISION

Provide in or adjacent to the control panel, all equipment and wiring necessary to connect to system to the campus Command Center located in the SMU Police Department.

Activation of any of the following signals shall automatically be reported to SMU Police Department Command Center via relays:
A. Fire Alarm System in Alarm.
B. Valve Tamper.
C. System Trouble.
D. Waterflow.
E. Fire Alarm System Power Off.

3.7 SPARE PARTS

The Fire Alarm System Contractor shall supply the University with a minimum of one replacement for each six devices (or fraction thereof) installed of the following devices:

A. Analog Smoke Detectors.
B. Addressable Manual Stations.
C. Interface Modules (monitor).
D. Interface Modules (control).
E. Horn/Strobe Signals.
F. Speaker/Strobe Signals.
G. Strobe Signals.
H. Duct Smoke Detectors.
I. Door Hold Open Devices.
J. Addressable Heat Detectors.

3.8 PROGRAMMING AND TEST DEVICES OR TOOLS

The Fire Alarm System Contractor shall furnish all devices necessary to conduct tests of all devices and equipment prior to substantial completion. Upon satisfactory completion of required tests, the Contractor shall furnish the University with two of each device, tool or accessory used and required to perform complete periodic tests and maintenance. Such devices or tools will include at a minimum interface devices, interface module programming tools, keys, program codes, and software. These devices, tools, and accessories shall become the property of the University.

Note: The fire alarm system is not connected to the fire department. Before any testing of the alarm system, notify campus police, 214-7683388. When applicable, complete and display fire system redtag (available from Campus Fire Safety Manager.

3.9 WIRING

All field wiring shall be installed in conduit. Conduit and boxes shall be sized according to National Electrical Code (NEC) requirements based on the number of conductors. Initiating device circuit wiring
shall be two-conductor, twisted with integral shield and ground. Notification appliance circuits shall be minimum 14 AWG. Primary power (AC) branch circuit conductors shall be minimum 12 AWG.

A. Identification: Fire alarm circuits shall be identified by red junction box covers stenciled in white letters "FIRE ALARM."

B. Circuit Testing: All wiring shall be tested for the following conditions before devices are installed or circuits connected to control equipment:
1. Verify that stray (unwanted) voltages do not exist between the installation conductors and ground or between conductors.
2. Verify all conductors not intentionally grounded are isolated from ground using an approved insulation testing device or "megger".
3. Verify that all conductors not intentionally connected together are isolated from one another using an approved insulation testing device or "megger".
4. Measure and record the loop resistance of each circuit with the conductor pair shorted together at the far end, verify that loop resistance does not exceed manufacturer's requirements.

C. Circuit Test Reports: Supply the University Electrical Engineer with a copy of all circuit testing reports and loop resistance readings.

3.10 SYSTEM TESTING

All initiating and notification appliances, control equipment, accessories, and auxiliary functions shall be tested in accordance with NFPA 72 acceptance test procedures. Representatives of the Office of Facilities Planning and Management (Facilities), Electrical Engineer, Manufacturer, City of University Park Fire Marshal, Fire Protection (Automatic Sprinkler) [if applicable] Contractor and Fire Safety Division in the Office of Risk Management and environmental Health & Safety shall be notified of the date and time of the test. A minimum of 14 days notice is required when scheduling the acceptance test. The Contractor is responsible for conducting all required tests. All necessary equipment and supplies shall be provided at Contractor's expense, including ladders, radios, test equipment, volt-ohm meter, sound-pressure (decibel) meter, flashlights, hand tools, and smoke or smoke substitute for functional tests. All test procedures shall conform to the Manufacturer's recommended test procedures and the NFPA 72 recommended practice. Subcontractors responsible for related work connected to, or controlled by, the fire alarm and detection system shall be available to demonstrate their equipment at the time of acceptance testing.

3.11 TEST REPORT

The Contractor shall prepare and submit a report of test in the form and content required by NFPA 72. The supervising technician or Fire Protection Engineer shall sign the report. The Contractor shall submit the report to the University Electrical Engineer and the Office of Risk Management upon completion of testing.

3.12 WARRANTY

The completed system shall be warranted for a period of one year from the date of acceptance. The warranty shall cover all defects in parts, alarm wiring, and workmanship, and expenses related to parts, labor and travel to and from the site for the purposes of correcting it. Maintenance and repair shall be performed only by a factory trained service technician.
3.13 TRAINING

Provide complete certified factory technical training for a minimum of two of the University's select representatives. The University's select representatives shall, upon completion of the above training, be factory qualified to perform complete maintenance and repair of the fire alarm system. The contractor shall assume the responsibility to coordinate with the University the location and time required for the above certified factory technical training. In addition to the above factory technical training, the general operation of the fire alarm system shall be demonstrated to the University's satisfaction. At least two formally scheduled sessions shall be conducted to allow for all facility personnel to attend.

3.14 AS-BUILT DRAWINGS

A. All deviations from the approved shop drawings require prior approval of Facilities and the University Electrical Engineer. Within 15 days of substantial completion, five copies of the as-built drawings indicating the location and configuration of all equipment, devices, wiring, conduit, and junction boxes shall be supplied to the University.

3.15 MANUALS

Five copies of the Manufacturer's operating manual, programming manual, and maintenance manual shall be supplied to the University within 15 days of substantial completion. Each manual shall include a print out of the point list with custom address for each device.

END OF SECTION 13855
Perimeter Drain Detail

- Foundation Wall
- Drain board
- Backfill
- Geotextile fabric
- Crushed stone
- Perforated/slitz
- Sch. 40 PVC pipe
SECTION 15720

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY
A. Air handling units and components as shown, scheduled, and indicated on the Drawings.

1.2 RELATED SECTIONS
A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.

B. Requirements of the following sections apply.
1. Section 15170 - Motors.
2. Section 15242 - Vibration Isolation.
3. Section 15290 - Ductwork Insulation.
4. Section 15410 - Plumbing Piping: Equipment Drains.
5. Section 15790 - Air Coils.
6. Section 15885 - Air Cleaning.
7. Section 15890 - Ductwork.
8. Section 15910 - Ductwork Accessories: Flexible Duct Connections.

1.3 QUALITY ASSURANCE
A. Manufacturers: The design shown on the drawing is based upon products of the manufacturer scheduled. Alternate equipment manufacturers will be acceptable if equipment meets the scheduled performance and complies with these specifications. If equipment manufactured by manufacturer other than that scheduled is utilized, then the Mechanical contractor shall be responsible for coordinating with the General Contractor and all affected Subcontractors to ensure proper provisions for installation of the furnished unit. This coordination shall include, but not be limited to, the following:
1. Structural supports for units.
2. Piping size and connection/headers locations.
3. Electrical power requirements and wire/conduit and overcurrent protection sizes.
4. The Mechanical Contractor shall be responsible for all costs incurred by the General Contractor, Subcontractors, and Consultants to modify the building provisions to accept the furnished units.

1.4 REFERENCES
A. AMCA 99 – Standard Handbook
B. AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes
C. AMCA 300 – Test Code for Sound Rating Air Moving Devices
D. AMCA 301 – Method of Publishing Sound Ratings for Air Moving Devices
E. AMCA 500 – Test Methods for Louvers, Dampers, and Shutters
F. ANSI/AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings
G. ANSI/UL 900 – Test Performance of Air Filter Units
H. ARI 410 – Forced-Circulation Air Cooling and Air Heating Coils
I. ARI 430 – Standard for Application of Central-Station Air Handling Units
J. ARI 435 – Standard for Application of Central-Station Air Handling Units.
K. NFPA 90A – Installation of Air Conditioning and Ventilation Systems
L. SMACNA – Low Pressure Duct Construction Standards

1.5 SUBMITTALS
A. Submit shop drawings and product data under provisions of Section___________.
B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.
C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, gauges, and finishes of materials. If product data is being submitted that covers a range of manufactures' equipment, then proposed equipment will be called out by arrows or highlighter.
D. Provide fan curves with specified operating point clearly plotted.
E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.
F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
G. Submit manufacturer's installation instructions under provisions of Section___________.
H. Provide manufacturer guarantee, signed by company director that air units will not sweat under design conditions. Failure to do so will result in submittal rejection.

1.6 OPERATION AND MAINTENANCE DATA
A. Submit operation and maintenance data under provisions of Section___________________.
B. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
1.7 **RATINGS AND CERTIFICATIONS**

A. Conform to AMCA 210 for fan performance ratings.

B. Conform to E.T.L. or U.L. standards.

C. Conform to ARI 410 for capacities, pressure drops, and selection procedures of air coils.

D. Conform to ARI 430 for all fabrication procedures of air handling units.

E. Utilize only ANSI/UL 900 listed Class I or Class II filter media, approved by local authorities.

1.8 **DELIVERY, STORAGE AND HANDLING**

A. All handling and storage procedures shall be per manufacturer’s recommendations.

1.9 **WARRANTY**

A. The manufacturer’s standard warranty shall be for a period of eighteen months from the date of shipment or 12 months from date of start-up, which ever is greater.
   1. The warranty shall include parts and labor during this period.
   2. The warranty shall not include parts associated with routine maintenance, such as belts, air filters, etc.

1.10 **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.

1.11 **EXTRA STOCK**

A. Provide one spare set of filters per unit.

B. Provide one set of spare fan belts for each unit.

**PART 2 - PRODUCTS**

2.1 **ACCEPTABLE MANUFACTURERS**

A. York Solution (Basis of Design)

B. Temtrol

C. Trane Air Systems

D. Daiken

2.2 **GENERAL DESCRIPTION**

A. Fabricate air handling units suitable for the scheduled capacities.
B. Factory fabricate and test air handling units of sizes, capacities, and configuration as indicated and specified.

C. Base performance on sea level conditions.

D. All internal components specified in the air handling unit schedule shall be factory furnished and installed. Units shall be completely factory assembled.

E. Units shall ship in one (1) piece whenever possible. A minimal number of shipping splits may be provided as required for installation. Shipping units completely unassembled in individual sections or modules is unacceptable. Lifting lugs will be supplied on each side of the split to facilitate rigging and joining of segments.

2.3 UNIT CASING

A. The outdoor units shall be specifically designed for curb mounting in an outdoor application. Weatherized indoor air handling units are not acceptable.

B. Air handling units shall be supplied with a full length, continuous base rail channel. Base rail height must be a minimum of 6” for indoor unit to ensure proper height for trapping. Lifting legs will not be accepted in lieu or base rail.
   1. The base rail channel shall be formed of 12-gauge minimum galvanized steel.
   2. The base rail channel shall support all major components.
   3. The unit base shall be supplied with a recessed curb mounting location.
      a. The recessed curb-mounting surface shall provide a continuous surface for field application of curb gasketing to create a weather-tight seal between the curb and unit.
      b. Units without a recessed mounting location for the roof curb shall not be acceptable.

C. Air handling units shall be supplied with double wall panels for walls, roof, and floor constructed of G90 mill galvanized sheet steel.
   1. All panels shall be formed and reinforced to provide a rigid assembly.
   2. The exterior casing shall be constructed of 20-gauge minimum galvanized steel.
   3. Exterior casing screws shall be stainless steel.
   4. The interior lining shall be a solid lining of a minimum of 20-gauge galvanized steel or 20-gauge galvanized perforated lining in specific segments as indicated.
   5. The walking surface of the floor panels shall be a solid lining of 18-gauge minimum galvanized steel with sufficient reinforcements to support the weight of maintenance personnel.
   6. Floors shall be double wall with 20-gauge minimum galvanized steel sub-floor enclosing the insulation under the unit.
   7. All wall, roof, and floor panels in the air handler shall be supplied with 2” (two inches) of insulation.
      a. Insulation shall be a full 2” (non-compressed) throughout the entire unit.
      b. Insulation for all panels, including roof, walls, and floor shall provide a minimum thermal conductivity R of 13 BTU/hr-ft2°F.
      c. Units with less than 2” of insulation in any part of the walls, floor, or roof shall not be acceptable.
      d. In addition to panel insulation, insulate all structural channels connected to casing panels and cover openings in structural channels with galvanized steel.
If structural channels are not internally insulated, then structural channels must be wrapped with an armaflex type insulation to maintain unit thermal performance and prevent sweating.

e. Insulation shall meet the flame and smoke generation requirements of NFPA 90A.

f. All pipe chases, header covers and return bend panels shall be fully insulated.

8. All panels shall be completely gasketed.

9. Unit shall have a maximum leakage of 1% at design total static pressure. One unit will be selected to be factory performance tested to ensure compliance. Manufacturer will be responsible for all costs associated with adjustments and additional tests to units to ensure compliance should unit fail leakage test.

D. Double wall access doors shall be provided on sections as scheduled. Doors shall be of the same thickness and construction as the wall panels. Hinges shall be made of stainless steel to prevent rust. A bulb type gasket shall be provided around the entire door perimeter. All doors shall open against positive pressure. If doors opening against positive pressure are not available, a safety chain mechanism and warning labels shall be provided to prevent injury to maintenance personnel.

E. Casing construction shall be such that the maximum deflection does not exceed L/200 for either width or height of panel measured at any point.

F. Casing construction to ensure that unit will not sweat under design conditions. All insulation shall be rated for an internal temperature of 48°F and mechanical room condition of 78°F Wet Bulb and 102°F Dry Bulb.

G. Outdoor air handling unit shall be supplied with a sloped roof to promote drainage of precipitation and prevent standing water.

1. The roof shall have a minimum pitch of 1/4" per foot.

2. The roof shall overhang the side panels to prevent precipitation drainage from streaming down the unit side panels.

3. Units supplied with flat roofs shall not be acceptable.

2.4 FANS

A. Provide most efficient for design conditions.

1. All fans shall bear the AMCA Seal. Fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air and sound. In addition, all fan wheels shall comply with AMCA standard 99 2408 69 and 99 2401 82.

2. Fan selection should be direct drive whenever feasible and subject to efficiency criteria above.

B. After the pre balanced fan is installed in the air handler, the entire fan section shall be run balanced at the specified speed to insure smooth and trouble free operation.

C. Filter-in measurements shall be taken in the horizontal and vertical planes on the drive and opposite-drive sides of the fan shaft.

D. Fans with variable frequency drives shall be balanced for inverter duty operation. The fan will be balanced over the entire range of fan operation (30% to 100% of RPM). Filter-in
measurements shall not exceed 5 mils in the horizontal and vertical planes. Filter-out measurements shall not exceed 7.5 mils in the horizontal, vertical, and axial planes.

E. Fan and fan motor shall be internally mounted and isolated on a full width isolator support channel using 2” springs. The fan discharge shall be connected to the fan cabinet using a flexible connection to insure vibration free operation.

2.5 BEARINGS AND DRIVES

A. Fan bearings shall be self aligning, pillow block, or flanged type sealed ball bearings, or rubber housed sealed bearings and shall be designed for an average life (L50) of at least 200,000 hours. All re-greaseable bearings shall be factory lubricated and equipped with standard hydraulic grease fittings and accessible for maintenance and inspection. In the event that a bearing is not accessible, a copper lube line shall extend from the bearing to the motor side of the air handler.

B. Fan drives shall be selected for a 1.5 service factor and anti static belts shall be furnished. All fans above 5 hp shall be fixed pitch. All fans shall be equipped with multiple belt drives. When feasible, direct drive fan arrangement is preferred.

C. Fan shafts shall be selected to operate well below the first critical speed and each shaft shall be factory coated after assembly with an anti-corrosion coating.

D. The number of belts installed will be one additional than required to transmit power from the motor (FLA) to the fan (N+1).

E. Small horsepower fans (less than 7.5 hp) using v-belt drives shall also have a v-belt auto tensioner.

2.6 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Fan motors shall be NEMA design ball bearing type with electrical characteristics and horsepower as specified on the schedule. All motors shall be premium efficiency. The motor shall be mounted on the same isolation base as the fan. The motor shall be on an adjustable base. Motor shall be VFD rated and be equipped with sealed bearings.

1. Select most efficient motor for application.
2. Electric motors 20 HP and larger, served by VFD, shall be equipped with a static electricity control system, e.g. Aegis, or similar.

B. Supply fan unloading control for all variable air volume units shall be accomplished through a factory mounted and wired variable frequency drive. Each drive shall be mounted in a dedicated, conditioned NEMA 3R compartment located on the side of its associated fan section. The VFD shall include the following features:

1. Microprocessor based, user friendly, multi-line alphanumeric control panel
2. Non-fused disconnect
3. Factory installed 3% input line reactor
4. RFI / EMI filter
5. Start-up and commissioning service by a factory trained and employed service technician
6. First year parts and labor warranty
C. The VFD shall be UL listed and comply with all applicable provisions of the National Electric Code.

D. The outdoor unit will be equipped with an externally mounted and wired NEMA 3R motor controls enclosures. The panels will contain a main power block, motor contactors with overload devices, three phase ambient compensated overload heater elements, primary control fuses, secondary control line size fuse, terminal strip and a panel mounted interlocking disconnect. All units will be provided with one electrical single point power connection. The panels and all associated components will be UL listed. All power wiring from the motor control panels to the supply and exhaust fan motors will be factory installed. Wiring will be done within NEC guidelines.

### 2.7 HEATING/COOLING COMPONENTS

A. Cooling coil segments shall have a full width, sloped drain pan that extends downstream of the coil a minimum of 8” to contain moisture carryover. The unit design and coil selection shall not require a drain pan in any downstream section to contain the coil condensate.  
1. Drain pans shall be sloped in a minimum of 2 planes; cross break interior pans and pitch toward drain connections to ensure complete condensate drainage. Units with cooling coils shall have drain pans under complete cooling coil section. A minimum of 1” clearance shall be provided from the bottom of the coil casing to the drain pan so that the drain pan can be visually inspected and physically cleaned, including underneath coil, without removal of the coil. All drain pan connections will be to one side of the unit to enable proper trapping. Drain pans that do not comply with these maintenance requirements will be the responsibility of the contractor to field modify.
2. The pan shall be of double wall construction with a stainless steel liner and shall be fully insulated. Thickness of stainless steel drain pans shall not be less than 20 gauge.
3. Drain pan shall be provided with a minimum 1-1/4" FPT condensate connection positioned beneath the lowest point of the drain pan.

B. Coils with finned height greater than 50" shall have an intermediate drain pan extending the entire finned length of the coil. Cooling coils in excess of 50" in height shall not be acceptable unless provided with an intermediate drain pan. The intermediate pans shall have drop tubes to guide condensate to the main drain pan and are to be made from non-ferrous material (copper) and secured to resist vibration.

C. All cooling and/or heating coils shall be furnished to meet the performance requirements set forth in the schedule. Cooling coil face velocity may not exceed 500 feet per minute. All water and steam coils shall have performance certified in accordance with ARI Standard 410. Coils used with glycol are outside the scope of ARI-410, but shall be selected to meet scheduled performance.

D. All coils shall be slide out, “shipping” type, mounted on tracks, and easily removable from the air handling unit by removing only one exterior panel. Coils that require additional disassembly of the unit or replacement of the entire coil section (e.g. “unit” type coils) for coil removal are unacceptable.

E. Drainable Water coils shall be designed to operate at 250 psig design working pressure and up to 300 deg F and shall be tested with 325 psig compressed air under water. Circuiting
shall provide free and complete draining and venting when installed in the unit. All vent and drain connections shall be extended to the outside of the unit casing, using SS or brass pipe and fittings.

1. Coils shall be circuited for counter flow of air and water. Water velocities shall not exceed 7 feet per second and/or exceed the water pressure drops scheduled. All coils shall have same end connections regardless of the number of rows deep. Units with staggered coil arrangements are unacceptable.

F. Coil casing, support members, fasteners, intermediate coil supports, and all other parts of the cooling section in contact with water to be constructed of stainless steel. Intermediate casing supports shall be supplied for finned lengths that exceed 60 inches.

G. The primary surface shall be 5/8" O.D. copper tube, staggered in direction of airflow. Tubes shall be mandrel expanded to form fin bond and provide burnished, work-hardened interior surface. The tubes shall have a minimum tube wall thickness of 0.020". Specified thickness shall be maintained throughout the tube including brazed U-bends.

H. Extended surface shall consist of die-formed, continuous, aluminum fins. The fins shall have fully drawn collars to accurately space fins, and to form a protective sheath for the primary surface. The fin thickness shall be 0.008".

I. Headers shall be of heavy seamless red brass tubing, silver-brazed to tubes. Connections shall be of non-ferrous pipe, with male pipe threads, silver-brazed to the headers. A 1/4" FPT, plugged vent or drain tap shall be provided on each connection. All vent and drain connections shall be extended to the outside of the unit casing.

1. Carbon steel runouts are not acceptable.

J. Coil grommets shall be provided on all coils to completely seal the area between the coil connection and the unit casing. Grommets shall be installed inside and outside where all piping passes though the walls of the AHU.

K. Maximum number of tube rows in a coil is six. Two banks of coils in series may be used along with access compartments on both sides of each coil.

L. Ensure full access to both sides of heat and cool decks for cleaning and inspection. Coils that are 4’ in length or less may have a bolt in removable access door/panel installed. If an additional coil is installed a minimum of 2’ will be left between coils. Coils greater than 4’ in length require a hinged access door panel and a minimum of 4’ between coils.

M. Provide access points on both sides of coil differential pressure readings. Access points must have the ability to be re-sealed after use.

2.8 FILTERS

A. Filters and filter segments shall be provided as scheduled. Filter frames shall be constructed of galvanized steel and be built as an integral part of the unit. Filter media shall be listed Class 1 under U.L. Standard 900 as required by local codes. AHUs shall be provided with Rigid Filter Segment designed to accommodate 2" 30-35% efficient pre-filter media (MERV 8) and 12" 90-95% efficient final filter media (MERV 14). A magnahelic, differential pressure gauge shall be factory installed and flush
mounted on drive side of the unit to measure the pressure drop across each filter bank. Construction filters shall be no less than (MERV 8) to meet "LEED" certification standard.

B. All filters will be lay-in type filter rack with gaskets and full size door access.
1. Secondary filtration to be 12 inch, 6 pocket, synthetic media bag filters, with a minimum MERV 14 rating. V Bank, rigid or mini-pleat filters will not be used unless specified by SMU.

C. Electrostatic filters will not be used as primary filtration. If electrostatic filtration is used, a pre-filter of MERV-8 will be installed.

2.9 APPURTENANCES

A. AHUs shall be supplied with an economizer segment.
1. The economizer segment shall have outside and return airstreams directed into each other by damper assemblies to facilitate mixing of the airstreams. All dampers, exhaust, return and outside air, should be sized for 100% nominal unit airflow
2. The economizer segment shall be supplied with a factory installed steel safety screen over all return air openings in the floor of the unit.

B. AHUs shall be supplied with access segments placed as indicated on the drawings.
1. Access segments shall have a minimum length of 18”. See plans for exact dimensions
2. Access segments shall be provided with a door on the drive side of the unit.

C. Curb-mounted air handling unit(s) located in exterior positions, subject to freezing ambient temperatures, shall be provided with an external pipe chase to enclose field piping and valves.
1. Pipe chase shall be 24” in nominal depth. Internal clearance may be approximately 7” less than nominal depth.
2. Pipe chase shall be fully insulated and have double wall construction.
3. Hinged access door(s) shall be provided.

D. Air handling unit shall be supplied with the manufacturer’s standard curb, shipped loose for field installation by others prior to unit placement.
1. Roof curb shall be a prefabricated galvanized steel-mounting curb.
2. Roof curb shall be a perimeter type with a complete perimeter support of the air handling unit.
3. The curb shall be a minimum of 14” high.
4. Gasketing shall be provided for field mounting between the unit base and the roof curb.
5. The curb shall include a 2” x 4” wood nailer.

2.10 DAMPERS

A. Dampers shall be low leakage design, air foil cross section, made of extruded aluminum or galvanized steel. Each damper blade shall have integral elastomeric edge seals with flexible metal jamb seals. All dampers to be opposed blade design. Exception by owner’s written approval only.
2.11 FINISHES

A. The outdoor air handling unit shall be painted prior to shipment.
   1. The exterior of the unit shall be completely cleaned prior to application of finished coats.
   2. A prime coat shall be applied to the unit.
   3. A finish coat of (owner approved color) acrylic polyurethane shall be applied.
   4. The finished unit shall exceed 500-hour salt spray solution (5%) without any sign of red rust when tested in accordance with ASTM B-117.

B. Unpainted (Indoor) units shall be shrink-wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Alternatively, units may be shipped in an enclosed truck. Units not factory shrink-wrapped shall be re-covered by the contractor at the job-site while awaiting installation.

2.12 Accessories

A. UVC lights at outlet of all cooling coils. 1-G30 T-8 fixture for every 4 sq.ft. of coil area. Lights shall be controlled be a 7-day digital wall switch timer.

B. Waterproof fixtures with 27w CFL or LED work lights and auxiliary electrical outlets will be provided in every section (i.e., filter, fan, coil).

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Installing contractor shall install air handling units, including components and controls required for operation, in accordance with air handling unit manufacturer’s written instructions and recommendations.
   1. Air handling units shall be stored only in a clean, dry place, protected from weather and construction traffic.
   2. Air handling units shall be handled such that damage to components, enclosure, and finish is avoided.
   3. Install in conformance with ARI 435.
   4. Isolate fan segments with flexible duct connections.
   5. AHU OA intakes shall be at the roof line.
   6. AHU must be mounted at least 6” above housekeeping pad, but not more than 12”.
   7. AHU will be installed where all access doors and entry points will fully open.
   8. Seal floor around any AHU installed above ground level with an epoxy waterproof barrier.

END OF SECTION 15720
SMU BAS Technical Compliance Checklist

Note: This is not a comprehensive listing of all specification requirements. It is instead a list of selected requirements that can be easily evaluated based upon manufacturer's literature, a bidder's proposal, or questions asked of the bidder. This list should not be used as the sole determination of whether or not a proposal meets the contract requirements, but it may prove useful as a starting point to compare the proposal to selected specification items. The references identify the section and paragraph of the specification where this requirement may be found.

Approved Vendors: Siemens, Inc.

Web-based System:

- Is the contractor supplying a web-based system? In a web-based system, operators can perform all normal operator functions (i.e. point command, alarm monitoring, time scheduling, graph trending data) using system graphics pages through a web browser on any PC connected to the network, and do not need to use a dedicated operator workstation running software purchased from the contractor. (Ref: 1.5.A)

Operator Workstation/Web Server Requirements:

- Is the contractor providing 1 web server (Ref: 2.3.A) that meets or exceeds the following specifications: (Ref: 2.3.C)
  - Intel Pentium 2.66 GHz processor
  - 1 GB RAM
  - 100 GB hard disk providing data at 100 MB/sec
  - 8x DVD-RW burner drive
- Is the web server supplied with a professional-grade operating system such as Microsoft Windows XP Pro, Red Hat Linux, or Sun Solaris? (Ref: 2.3.E.1)
- Does the web server reside on an Ethernet network using the BACnet/IP Protocol? (Ref: 2.3.B)
- Does the operator workstation software conform to the BACnet OWS device profile? Is this product listed by the BACnet Testing Laboratories as conforming to this BACnet profile? This can be quickly checked at [http://d1449527.u49.0web-hosting.com/btl/](http://d1449527.u49.0web-hosting.com/btl/). (As of this writing, the BTL has not yet tested Operator Workstations. If the product is not yet listed, check the BMA catalog at [http://d1449527.u49.0web-hosting.com/BMAProductCatalog.htm](http://d1449527.u49.0web-hosting.com/BMAProductCatalog.htm) to see if the manufacturer intends to certify this product.) (Ref: 2.3.H) {TAC is the only vendor approved to provide LON as exception but is still required to include all necessary information and capability to convert all data from LON to BACnet}
- Is the contractor providing all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal? An operator should be able to connect this terminal to the system network or directly to each controller for programming, setting up, and troubleshooting. (Ref: 2.3.G)

Controllers:

- Is the complete control logic, including all I/O points, for each piece of HVAC equipment contained within a single controller to provide stand-alone control in the event of communication failure? (Ref: 2.5.C.4)
• Is each controller provided with a service communication port for connection to a Portable Operator's Terminal? Does this connection support memory downloads and other commissioning and troubleshooting operations. (Ref: 2.2.C) Are the service connections extended to space temperature sensor ports where shown on drawings? (Ref: 2.5.C.1)

• Is the contractor supplying a keypad/display for each Building Controller and Advanced Application Controller in the project? If not, is the contractor supplying the software and all interface cabling needed to connect a laptop computer to these controllers and use it as a portable operator's terminal? (Ref: 2.5.E)

• Does the system use the BACnet protocol for communication to the operator workstation or web server and for communication between controllers? (Ref: 1.5.D) {TAC is the only vendor approved to provide LON as exception but is still required to include all necessary information and capability to convert all data from LON to BACnet}

• Does the control hardware conform to applicable BACnet device profiles? Are the products listed by the BACnet Testing Laboratories as conforming to BACnet profiles? This can be quickly checked at http://d1449527.u49.0web-hosting.com/btl/ (Ref: 2.5.B) {TAC is the only vendor approved to provide LON as exception but is still required to include all necessary information and capability to convert all data from LON to BACnet}

**User Interface:**

- Does the system have a graphical interface with point & click navigation that allows the operator to log in, view and adjust properties in a full programming capacity (i.e.: setpoints, schedules, PID gains, etc.), view and respond to alarms, view and configure trend graphs (including multiple points on one page), and view & configure reports? (Ref: 2.3.D)

- Will the system provide one graphic per each piece of equipment or occupied zone? Will the system graphics include floor plans that use dynamic colors to represent each zone's temperature relative to its setpoint? (Ref: 2.3.E.2)

- Does the system provide scheduling capabilities that include a weekly repeating schedule, the ability to schedule exceptions (dated changes to the weekly schedule) up to 365 days in advance, and annual holiday schedules that repeat each year? (Ref: 2.4.C)

- Does the system or the application programs provide a demand limiting function that will automatically adjust setpoints and de-energize low priority equipment when power consumption exceeds a user definable level? (Ref: 2.4.H)

**System Programming and Maintenance Tools:**

- Will the contractor provide all tools necessary to program and maintain the system? Tools must provide the capability to: (Ref: 2.3.F)
  - Configure the system database
  - Download memory to the controllers
  - Add operators, delete operators, and control privileges of each operator
  - Configure alarms, alarm messages, and alarm reactions (print, send e-mail, start program, etc.)
  - Configure trends including setting the interval time or change of value increment (without incurring any data loss) that causes a trend sample to be recorded
  - Configure and run standard reports to show point status, alarm status, locked points, and operator activity
  - Create and edit system graphics and to display dynamic system data on the graphics
Create and edit custom control programs and download these programs to the controller using a true graphical programming engine with capacity to run simulation of any applicable sequences.

- Does the programming language allow the user to develop custom control programs that include standard mathematical and Boolean functions, read values from sensors or from other control modules on the network, and activate the controller outputs or communicate with other control modules based upon the results? (Ref: 2.3.F.18)
- Can the operator run the program in a simulation mode, adjusting input variables to simulate actual operating conditions and stepping through the program while observing intermediate values and results? Can the operator adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic? (Ref: 2.3.F.18.d)
- Is the programming language graphically based, arranged in a logic diagram that clearly shows control logic flow? (Ref: 2.3.F.18.a)
- Are BACnet objects being used for all schedules, setpoints, trends, and alarms listed in the Sequences of Operation and Points Lists? (Ref: 1.5.D) {TAC is the only vendor approved to provide LON as exception but is still required to include all necessary information and capability to convert all data from LON to BACnet}

**Operator Security:**

- Does the system security allow an authorized operator to control the privileges associated with each user name & password combination? Privileges should include the ability to view, edit, add, and delete objects or functions. (Ref: 2.3.F.5)
- Can an authorized operator add, delete, and configure privileges for other operators? (Ref: 2.3.D.9)
- Does the system provide an adjustable automatic log-out time? (Ref: 2.3.F.5.b)
- Are stored operator passwords encrypted so they cannot be read by others? (Ref: 2.3.F.5.c)
- Can authorized operators vary and deny each operator's accessible functions based on equipment or geographic location. (Ref: 2.3.F.5.a)

**Web Services Support:**

- Does the system provide the following Web services? (Ref 2.2.G)
  - Support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
  - Support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
  - For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.

**WAP Interface:**

- Is the contractor providing a WAP interface compatible with a locally available commercial wireless network? Operators should be able to use this system to log in, view & acknowledge any alarm, navigate to any piece of equipment in the system, view status of critical I/O points, and lock points to a specific value. (Ref: 2.3.A)
**SMU BAS**  
**Metering & Energy/Environmental Auditing Compliance Worksheet**

Is the Controls Contractor able to meet each of these objectives?: (Any non-compliance issues must be noted on this sheet and attached to the SMU BAS Project Bid Acceptance Form)

A. Provide an intuitive, easily configured reporting tool with the Building Automation workstation that allows the user to create as a minimum the energy reports detailed below.
   - Energy Reports Types: Consumption, Demand
   - Metered Energy Sources: Electricity, Chilled water, Steam, Gas, & Domestic water
   - Metered Potable Water: Cooling Tower Condensate, Ground Water, etc
   - Energy Report Graphs formats: Bar, Line, Totalized, Pie and tabular data
   - Engineering Units and Normalized Data available in graphical formats: Kwh (MWH), Kbtu/hr, Kwh/square foot, Kbtu/hr/square foot/year, Kwh/square foot/occupied hour, Ilbs CO2, Llbs CO2/sq.ft

B. The energy reporting tools shall be accessible through any type of browser (Internet Explorer, Firefox, etc) and be very user intuitive for the end-user customer. The energy reporting tool shall be pre-configured by the BAS contractor to interrogate all metered data in the BAS historical trends database using BACnet/IP, Web-Services, SQL Query Language or other open mechanisms.

C. Metered data shall be stored at 5 minute intervals for consumption and demand for each metered energy source unless specified otherwise. Energy data shall be stored and available for a period not less than five years in an SQL or Oracle Database. Only SQL (MS SQL or Open-source SQL, and Oracle databases are acceptable for storage of energy data).

D. The BAS controls contractor shall be responsible for all configurations of the Energy and Environmental Performance reporting tool. No knowledge of Databases, SQL queries or any programming language shall be required by the end-user customer to generate energy reports.

E. Metered sources shall be shown for each building in a ‘tree’ configuration and data ranges selected on the fly by using an easy-to-use calendar control. Additionally, there shall be a ‘compare to’ calendar, so that one time period can easily be compared to another period, e.g. 2007 annual consumption to 2006 consumption annual.

F. Additionally, the end-user shall be able to schedule configured energy reports to run on a recurring basis: For example, a monthly consumption report shall be scheduled to automatically be generated on the first Monday of the following month, archived on the server in both Adobe PDF and Microsoft Excel, and automatically emailed to designated personnel in the end-user organization.

G. Low/ Average / High data shall be optionally displayed on the graph by clicking an appropriate button on a chart toolbar.

H. Benchmarking shall be incorporated into the energy reporting tool, allowing the customer to enter utility data for any periods prior to the presence of meters connected to the BAS. If the benchmark data has been entered, it shall be optionally be shown on the same graph by clicking an appropriate button on the chart toolbar.

I. Cooling and Heating Degree Days data shall be optionally shown graphically on top of the consumption graphs, by clicking an appropriate button in a toolbar.

J. Occupied/Unoccupied energy consumption shall be displayed by use of color. For example, a monthly consumption reports shown by day shall display unoccupied usage in a different color to occupied usage.
K. Environmental performance of the control system shall be displayed as a percentage index for each time period displayed. For example, if consumption data for each day of the month is shown, then the Environmental Index shall be annotated to the consumption graph for each day.

L. An Environmental Index shall be calculated and stored in the BAS historical trends database for each separate zone controlled. The Environmental Index shall be trended at 15 minute intervals and be accessible through the Energy and Environmental Performance reporting tool by clicking an appropriate button on the chart toolbar.

- Environmental Index shall be calculated as follows: System shall monitor all occupied zones and compile an index that provides a numerical indication of the environmental comfort within the zone. As a minimum, this indication shall be based upon the deviation of the zone temperature from the heating or cooling setpoint. If humidity is being measured within the zone then the environmental index shall be adjusted to reflect a lower comfort level for high or low humidity levels. Similarly, if carbon dioxide levels are being measured as an indication of ventilation effectiveness then the environmental index shall be adjusted to indicate degraded comfort at high carbon dioxide levels. Other adjustments may be made to the environmental index based upon additional measurements. The system shall maintain a trend of the environmental index for each zone in the trend log. The system shall also compute an average comfort index for every building included in this contract and maintain trend logs of these building environmental indices. Similarly, the system shall compute the percentage of occupied time that comfortable conditions were maintained within the zones. Through the UI the user shall be able to add a weighting factor to adjust the contribution of each zone to the average index based upon the floor area of the zone, importance of the zone, or other static criteria.
SMU BAS Project Bid Acceptance Form

Instruction to all BAS Vendor bidders:

1. All bidders are required to use this bid form for submission of their proposal.

2. Each bidder is required to detail their compliance with these specifications. Where the bidder deviates from the specification. The bidder shall fully and explicitly describe deviations, if any, from the specified requirements detailed in the SMU BAS Technical Compliance AND the SMU BAS Metering & Energy/Environmental Compliance Worksheet. This will be the only opportunity to provide this information; any specification feature not provided must be detailed or will be expected during the commissioning phase of this project.

Signature of Acceptance: ______________________________

3. Attach a schematic of basic system architecture and label all major components, Attached shall be cut sheets and engineering data of equipment be bid. Submittals of only brochures will not be accepted.

4. Pricing:

Each bidder is to detail future pricing Use this project as a model. It is desired that this be the method used for all future projects. Each bidder is to detail future labor costs, parts pricing discounts and subcontractor mark up levels. Please attach a detailed breakdown of all costs in a format that will be used for future projects.

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*Must provide software licensing for (50) Fifty Simultaneous Users.

5. Integration pricing. What are the costs associated with integrating a BACnet based system from another manufacture? Detail here the hardware and software required to provide this integration for this project. Give a cost breakdown as detailed below?

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDC Equipment</td>
<td>$</td>
</tr>
<tr>
<td>*Software</td>
<td>$</td>
</tr>
<tr>
<td>Related Devices (Sensors &amp; Valves)</td>
<td>$</td>
</tr>
<tr>
<td>Engineering Labor</td>
<td>$</td>
</tr>
<tr>
<td>Technician Labor</td>
<td>$</td>
</tr>
<tr>
<td>Project Management</td>
<td>$</td>
</tr>
<tr>
<td>Subcontractor Cost</td>
<td>$</td>
</tr>
<tr>
<td>Miscellaneous Costs/Expenses</td>
<td>$</td>
</tr>
<tr>
<td>Mark Up Fee</td>
<td>$</td>
</tr>
<tr>
<td>Project Total</td>
<td>$</td>
</tr>
</tbody>
</table>
6. DDC Parts Pricing Agreement - Attach Published Price List and discount/multiplier for a (5) five year period for all DDC Hardware and Software.

Discount (in multiplier, i.e.: 0.3 of list price) _______________

7. Service hourly rates – Detail hourly rates for service:

Online Service ________________$/Hour
Minimum Hourly Charge ________________Hours
Onsite Technician ________________$/Hour
Minimum Hourly Charge ________________Hours
Mileage Charge ________________$/Mile

8. Software Support – Provide pricing for an annual software support agreement. At a minimum the agreement shall include the following services:

- Upgrades and Patches within 30 days of their release
- Phone Technical Support (Normal Business Hours)
- 4 Hour Response to Service Requests
- Classroom Operator Training for (2) Individuals (Yearly)

Annual Costs:
Year 1 ________________
Year 2 ________________
Year 3 ________________
Year 4 ________________
Year 5 ________________

The Engineer and Owner shall reserve all authority regarding approval, conditional approval, or rejection of systems not fully complying with these specifications.

WARRANTY:

The temperature control contractor shall guarantee all workmanship and material in the installed temperature regulation system for a period of one (1) year, such guarantee dating from the date of final acceptance of the entire air conditioning system by the Architect/Engineer.

This warranty shall cover the repair or replacement without additional costs to the Owner of any defective materials, parts, etc. of facility workmanship. During the warranty period, the temperature controls contractor shall respond to calls for warranty service within eight (8) working hours. Emergency service shall be obtainable within four (4) hours of notification by the Owner. Emergency service shall be obtainable on a 24 hour basis, seven (7) days per week.

Warranty Access:
The Owner shall grant to the Contractor, reasonable access to the EMCS system during the warranty period. The owner shall provide, at no cost to the contractor, a dedicated voice grade telephone extension for remote telecommunications during this period and notification of desired exceptions. Modem shall provide the following functions:

- Access to the entire facility control system by the contractor to provide service and diagnostic support.
- Service: All service of the system shall be furnished by the Contractor, at no cost to the Owner, for a period of one (1) year, concurrent with the warranty period specified above.

General Specification Compliance and Deviation Checklist

- BACnet
- Web/server based
- Graphical Programming
- Energy Reporting Application
- Environmental Index
- All available Engineering Tools
- Server Spec
- Network Diagram
Section 23 09 00
Instrumentation and Control for HVAC

SMU BAS Controls Specifications
New Construction Model

Prepared By:
SMU Building Automation Systems, Control Systems Administrator
SECTION 15911
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 PRODUCTS FurnISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 09 13.23 - Sensors and Transmitters:
   1. Flowmeters
   2. Pressure and temp sensor wells & sockets
   3. Temp sensor wells and sockets

B. Section 23 09 13.33 - Control Valves:
   1. Control valves

C. Section 23 70 00 - Central HVAC Equipment:
   1. AHU, heating, and ventilating unit controls

D. Section 23 80 00 - Decentralized HVAC Equipment:
   1. Terminal unit controls

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. None

1.3 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. General:
   1. Coordination Meeting: The Installer furnishing the DDC network shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface including PICS for BACnet equipment, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the DDC network. Submittals for these products shall not be approved prior to the completion of this meeting.

B. Section 23 36 00 - Air Terminal Units:
   1. VAV boxes: VAV Terminal Units shall be furnished configured to accept control inputs from an external building automation system controller as specified in Section 23 09 93. A factory mounted transformer shall convert the 120VAC power provided by the DIV 26 Job Electrician to 24VAC for the BAS controller. Factory mounted safeties and other controls shall not interfere with this controller.
C. Section 23 80 00 - Decentralized HVAC Equipment:
1. Unit ventilators, unit heaters, fan coils, etc.: Unit ventilators, unit heaters, fan coils, cabinet heaters, convective or fin tube heaters, zone reheat, and similar terminal units: These units shall be furnished configured to accept control inputs from an external building automation system controller as specified in Section 23 09 93. A factory mounted transformer shall convert the Unit specific power provided by the DIV 26 Job Electrician to 24VAC for the BAS controller. Factory mounted safeties and other controls shall not interfere with this controller.

D. Section 26 29 00 - Low-Voltage Controllers:
1. Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and monitoring points specified in Section 23 09 93. These specified points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by one of the following methods: (a) Hardwired connection such as relay, 0-10VDC, or 4-20mA. (b) BACnet/IP network connection. (c) BACnet MS/TP network connection.

E. Communications with Third Party Equipment:
1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interface for integration into the Direct Digital Control System described in this section.

1.4 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

B. The following sections constitute related work:
1. Section 01 30 00 - Administrative Requirements
2. Section 01 60 00 - Product Requirements
3. Section 01 80 00 - Performance Requirements
4. Section 01 90 00 - Life Cycle Activities
5. Section 23 05 00 - Common Work Results for HVAC
6. Section 23 20 00 - HVAC Piping and Pumps
7. Section 23 30 00 - HVAC Air Distribution
8. Section 23 40 00 - HVAC Air Cleaning Devices
9. Section 23 50 00 - Central Heating Equipment
10. Section 23 60 00 - Central Cooling Equipment
11. Section 23 70 00 - Central HVAC Equipment
12. Section 23 80 00 - Decentralized HVAC Equipment
13. Section 26 05 00 - Common Work Results for Electrical
14. Section 26 06 00 - Schedules for Electrical
15. Section 26 09 00 - Instrumentation and Control for Electrical Systems
16. Section 26 20 00 - Low Voltage Electrical Transmission
17. Section 26 29 00 - Low-Voltage Controllers (Motor Controllers and VFD Drives)
18. Section 26 30 00 - Facility Electrical Power Generating and Storing Equipment (UPS, Backup Generators)
19. Section 26 50 00 - Lighting
20. Section 28 00 00 - Electronic Safety and Security (includes Fire and Smoke)
1.5 DESCRIPTION

A. A fully integrated Siemens Apogee BACNET Building Automation System (BAS), incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as manufactured by Siemens Industry. Building Controllers (BCs) shall reside on the SMU “Energy Management” Ethernet Network.

B. The system shall directly control HVAC equipment as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified in the sequence.

C. Provide for future system expansion to include monitoring of fire alarm, and lighting control systems.

D. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends, and alarms specified in Section 23 09 93 – “Sequence of Operations for HVAC Controls” shall be BACnet objects.

1.6 APPROVED CONTROL SYSTEMS

A. The following is the only approved control system supplier, manufacture, and product line:

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Manufacturer</th>
<th>Product Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Branch</td>
<td>Siemens Building Technologies</td>
<td>APOGEE System</td>
</tr>
<tr>
<td></td>
<td>Contact Siemens SMU Account Executive</td>
<td>(972) 550-8488</td>
</tr>
</tbody>
</table>

B. Inclusion on this list is not a guarantee of acceptance of products or installation. Control systems shall comply with the terms of this specification.

1. Installer and Manufacturer Qualifications

1.7 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications
1. Installer shall have an established working relationship with Control System Manufacturer.
2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.8 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
1. National Electric Code (NEC)
2. International Building Code (IBC)
   a. Section 719 Ducts and Air Transfer Openings
   b. Section 907 Fire Alarm and Detection Systems
   c. Section 909 Smoke Control Systems
   d. Chapter 28 Mechanical
3. International Mechanical Code (IMC)

1.9 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. All Operator Workstation Hardware shall be provided by SMU.
1. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
2. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
3. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
4. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
5. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
6. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
7. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
8. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

<table>
<thead>
<tr>
<th>Measured Variable</th>
<th>Reported Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±0.5°C (±1°F)</td>
</tr>
<tr>
<td>Ducted Air</td>
<td>±0.5°C (±1°F)</td>
</tr>
<tr>
<td>Outside Air</td>
<td>±1.0°C (±2°F)</td>
</tr>
</tbody>
</table>

Table 1 Reporting Accuracy
Table 2
Control Stability and Accuracy

<table>
<thead>
<tr>
<th>Controlled Variable</th>
<th>Control Accuracy</th>
<th>Range of Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pressure</td>
<td>±50 Pa (±0.2 in. w.g.)</td>
<td>0-1.5 kPa (0-6 in. w.g.)</td>
</tr>
<tr>
<td></td>
<td>±3 Pa (±0.01 in. w.g.)</td>
<td>-25 to 25 Pa (-0.1 to 0.1 in. w.g.)</td>
</tr>
<tr>
<td>Airflow</td>
<td>±10% of full scale</td>
<td></td>
</tr>
<tr>
<td>Space Temperature</td>
<td>±0.5ºC (±1.0ºF)</td>
<td></td>
</tr>
<tr>
<td>Duct Temperature</td>
<td>±0.5ºC (±1ºF)</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>±5% RH</td>
<td></td>
</tr>
<tr>
<td>Fluid Pressure</td>
<td>±10 kPa (±1.5 psi)</td>
<td>0-12.5 kPa (0-50 in. w.g.) differential</td>
</tr>
<tr>
<td></td>
<td>±250 Pa (±1.0 in. w.g.)</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Accuracy applies to 10% - 100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

1.10 SUBMITTALS

A. Product Submittal Requirements: Meet requirements of Section 01 30 00 on Shop Drawings, Product Data, and Samples. Provide four copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable). When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals within 10 weeks of contract award on the following:

1. Direct Digital Control System Hardware
   a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
   b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
      1) Direct digital controllers (controller panels)
      2) Transducers and transmitters
      3) Sensors (include accuracy data)
4) Actuators
5) Valves
6) Relays and switches
7) Control panels
8) Power supplies
9) Batteries
10) Operator interface equipment
11) Wiring

c. Wiring diagrams and layouts for each control panel. Show termination numbers.
d. Floor plan schematic diagrams indicating all field sensors (i.e. tstat, downstream static sensors, field mounted AFMS, ect...), as defined by the Mechanical Engineer of record, and controller locations.
e. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software
   a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.
   b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
      1) Power supplies
      2) Battery backups
      3) Interface equipment between CPU or server and control panels
      4) Operating System software
      5) Operator interface software
      6) Color graphic software
      7) Third-party software
   c. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
   d. Network riser diagrams of wiring between central control unit and control panels.

3. Controlled Systems
   a. Riser diagrams showing control network layout, communication protocol, and wire types.
   b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements and panel locations.
   c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
   d. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
   e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

4. Description of process, report formats, and checklists to be used in Section 23 09 23 Article 3.16 (Control System Demonstration and Acceptance).
5. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

B. Schedules
1. Schedule of work provided within one month of contract award, indicating:
   a. Intended sequence of work items
   b. Start date of each work item
   c. Duration of each work item
   d. Planned delivery dates for ordered material and equipment and expected lead times
   e. Milestones indicating possible restraints on work by other trades or situations
2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Submit digital copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:
1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2006 (or newer) compatible files on compact/optical disk (file format: .DWG, .DXF, .VSD, or comparable).
2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 23 09 23 Article 3.16 (Control System Demonstration and Acceptance).
3. Operation and Maintenance (O&M) Manual. Printed, electronic, or online help documentation of the following:
   a. As-built versions of submittal product data.
   b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
   c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
   d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
   e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
   f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
   g. Graphic files, programs, and database on magnetic or optical media.
   h. List of recommended spare parts with part numbers and suppliers.
   i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
   j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
k. Licenses, guarantees, and warranty documents for equipment and systems.

l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: At a minimum, provide 4 Hours of project system review. Larger projects should include more defined hours. Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.11 WARRANTY

A. Warranty Implementation Procedure is as follows:

1. It is not acceptable for Contractor to assign start of warranty date/period without first receiving SMU’s acceptance of project and their provision of an agreed upon date to start the warranty in writing.

2. Contractor must contact SMU to establish project completion and request a punchlist in writing.

3. SMU will provide punchlist within 15 working days and set meeting with Contractor to turnover the punchlist and to provide written approval for the start of warranty period.

4. The warranty will begin the day that SMU signs the start of warranty paperwork and provides punchlist.

5. Contractor may then utilize the following 90 days to accomplish punchlist completion. Additional extensions of this punchlist completion period will not be granted by SMU.

6. Should Contractor default on achieving punchlist completion within this period, the end of warranty date will be adjusted forward by the number of days that punchlist completion remained in default. (i.e.: Warranty Start Date=2-15-08, Expected Warranty End Date=2-15-09, Expected Punchlist Completion Date=5-15-08, Actual Punchlist Completion Date=7-15-08, New Warranty End Date=4-15-09)

7. Contractor must seek signature approval from SMU confirming punchlist completion and, if applicable, to establish the new end of warranty date.

8. These procedures apply independent of any requirements established by a general contractor or otherwise direct dictating entity to the Contractor as required in construction contracting chain.

B. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.

2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If Engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, Engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.

4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Must demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.12 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
   1. Graphics
   2. Record drawings
   3. Database
   4. Application programming code
   5. Documentation

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Use products detailed in Owner Master Points specifically approved by Owner for each type of sensor/point. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2004, BACnet.

B. Network wiring and all network infrastructure hardware for Building Controllers (BCs) shall be provided and coordinated by an SMU approved network contractor. Unless specifically included, this scope shall not be by Building Automation contractor.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
   1. An operator interface connected to a controller shall allow the operator to interface
      with each internetwork controller as if directly connected. Controller information
      such as data, status, and control algorithms shall be viewable and editable from each
      internetwork controller.
   2. Inputs, outputs, and control variables used to integrate control strategies across
      multiple controllers shall be readable by each controller on the internetwork.
      Program and test all cross-controller links required to execute control strategies
      specified in Section 23 09 93. An authorized operator shall be able to edit cross-
      controller links by typing a standard object address or by using a point-and-click
      interface.

E. Controllers with real-time clocks shall use the BACnet Time Synchronization service.
   System shall automatically synchronize system clocks daily from an operator-designated
   controller via the internetwork. If applicable, system shall automatically adjust for daylight
   saving and standard time.

F. System shall be expandable to at least twice the required input and output objects with
   additional controllers, associated devices, and wiring.

2.3 OPERATOR INTERFACE

A. Operator Interface. Server shall reside on a SMU maintained high-speed network with
   building controllers. Each standard browser connected to server shall be able to access all
   system information. In addition to the primary operator interface, the system shall include a
   secondary interface compatible with a locally available commercial wireless network and
   viewable on a commercially available wireless device such as a Wireless Access Protocol
   (WAP) enabled cellular telephone or tablets. This secondary interface may be text-based
   and shall provide a summary of the most important data. As a minimum, the following
   capabilities shall be provided through this interface:
   1. An operator authentication system that requires an operator to log in before viewing
      or editing any data, and which can be configured to limit the privileges of an
      individual operator.
   2. The ability to view and acknowledge any alarm in the system. Alarms or links to
      alarms shall be provided on a contiguous list so the operator can quickly view all
      alarms.
   3. A summary page or pages for each piece of equipment in the system. This page shall
      include the current values of all critical I/O points and shall allow the operator to
      lock binary points on or off and to lock analog points to any value within their range.
   4. Navigation links that allow the operator to quickly navigate from the home screen to
      any piece of equipment in the system, and then return to the home screen. These
      links may be arranged in a hierarchical fashion, such as navigating from the home
      screen to a particular building, then to a specific floor in the building, and then to a
      specific room or piece of equipment.

B. Communication. Server or workstation and controllers shall communicate using BACnet
   protocol. Server or workstation and control network backbone shall communicate using
   ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as
C. **Operator Functions.** Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. **Log In and Log Out.** System shall require user name and password to log in to operator interface.
2. **Point-and-click Navigation.** Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.
3. **View and Adjust Equipment Properties.** Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.
4. **View and Adjust Operating Schedules.** Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.
5. **View and Respond to Alarms.** Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.
6. **View and Configure Trends.** Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.
7. **View and Configure Reports.** Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.
8. **Manage Control System Hardware.** Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.
9. **Manage Operator Access.** Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

D. **System Software.**

1. **System Graphics.** Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
   a. **Functionality.** Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.
   b. **Animation.** Graphics shall be able to animate by displaying different image files for changed object status.
   c. **Alarm Indication.** Indicate areas or equipment in an alarm condition using color or other visual indicator.
E. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. Operators shall be able to configure the system.

4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.

5. Security. System shall require a user name and password to view, edit, add, or delete data.
   a. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.
   b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

6. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls. Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall
be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls. Trends shall be BACnet trend objects.

12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:
   a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
   c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
      1) Alarm History.
      2) Trend Data. Operator shall be able to select trends to be logged.
      3) Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:
   a. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.
   b. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.
c. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
d. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.
e. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.
   1) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.
   2) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

2.4 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.3.F.5 (Security) and Paragraph 2.3.F.15.c (Operator Activity).

C. Scheduling. See Paragraph 2.3.D.4 (View and Adjust Operating Schedules). System shall provide the following schedule options as a minimum:
   1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
   2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.
   3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

E. Binary and Analog Alarms. See Paragraph 2.3.F.7 (Alarm Processing).

F. Alarm Reporting. See Paragraph 2.3.F.9 (Alarm Reactions).

G. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

H. Demand Limiting.
1. System shall monitor building power consumption from building power meter pulse
generator signals or from building feeder line watt transducer or current transformer.

I. Maintenance Management. System shall generate maintenance alarms when equipment
exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable
maintenance alarms as specified in Section 23 09 93 – Sequence of Operations for HVAC
Controls.

J. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified
in Section 23 09 93 – Sequence of Operations for HVAC Controls.

K. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-
derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled
variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog
value that can be used to position an output or to stage a series of outputs.

L. Staggered Start. System shall stagger controlled equipment restart after power outage.
Operator shall be able to adjust equipment restart order and time delay between equipment
restarts.

M. Energy Calculations.
1. System shall accumulate and convert instantaneous power (kW) or flow rates (L/s
[gpm]) to energy usage data.
2. System shall calculate a sliding-window average (rolling average). Operator shall be
able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

N. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means
of adjustable minimum on-time and off-time settings.

O. On and Off Control with Differential. System shall provide direct- and reverse-acting on
and off algorithms with adjustable differential to cycle a binary output based on a
controlled variable and setpoint.

P. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each
binary input and output. Operator shall be able to enable runtime alarm based on exceeded
adjustable runtime limit. Configure and enable runtime totalization and alarms as specified
in Section 23 09 93 – Sequence of Operations for HVAC Controls.

2.5 CONTROLLERS

A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC),
Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as
required to achieve performance specified in Section 23 09 23 Article 1.9 (System
Performance). Every device in the system which executes control logic and directly
controls HVAC equipment must conform to a standard BACnet Device profile as specified
in ANSI/ASHRAE 135-2004, BACnet Annex L. Unless otherwise specified, hardwired
actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

B. BACnet.
1. Building Controllers (BCs). Each BC shall conform to BACnet Building Controller
(B-BC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L

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and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.


3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.

C. Communication.
1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation. Each piece of equipment specified in Section 23 09 93 shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

D. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

F. Serviceability.
1. Controllers shall have diagnostic LEDs for power, communication, and processor.
2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory.
1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
H. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

I. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2
service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
   a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
   b. Line voltage units shall be UL recognized and CSA listed.

2.8 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers
   1. Type. Control dampers shall have linear flow characteristics and shall be parallel- or opposed-blade type as specified below or as scheduled on drawings.
      a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
      b. Other modulating dampers shall be opposed-blade.
      c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.
   2. Frame. Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (1/8 in.) extruded aluminum with reinforced corner bracing.
   3. Blades. Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).
   4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
   5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s•m2 (10 cfm per ft2) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).
   6. Sections. Damper sections shall not exceed 125 cm - 150 cm (48 in. - 60 in.). Each section shall have at least one damper actuator.
   7. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators
   1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
   2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
   3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
   4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N•m (60 in.-lb) torque capacity shall have a manual crank.

6. For all 2-position control OA (or otherwise) dampers which require to be open for unit operation end-position switch shall be installed to provide feedback indication of damper position independent of control actuator internal end position switch.

C. Control Valves.
1. General. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.
2. Type. Provide two- or three-way control valves for two-position or modulating service as shown.
   a. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.
   b. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.
      1) Two-way: 150% of total system (pump) head.
      2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
   c. Ports. Valves providing modulating service shall have equal percentage ports.
   d. Sizing.
      1) Two-position service: line size.
      2) Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35 kPa (5 psi).
      3) Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 35 kPa (5 psi).
   e. Fail Position. Water valves shall fail normally open or closed as follows unless otherwise specified.
      1) Water zone valves: normally open.
      2) Heating coils in air handlers: normally open.
      3) Chilled water control valves: normally closed.
      4) Other applications: as scheduled or as required by sequences of operation.

4. Steam Valves.
   a. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide minimum close-off pressure rating equal to 150% of operating (inlet) pressure.
   b. Ports. Valves providing modulating service shall have linear ports.
   c. Sizing.
      1) Two-position service: select pressure drop equal to 10%-20% of inlet psig.
      2) Modulating service at 100 kPa (15 psig) or less: select pressure drop equal to 80% of inlet psig.
      3) Modulating service at 101-350 kPa (16-50 psig): select pressure drop equal to 50% of inlet psig.
4) Modulating service at over 350 kPa (50 psig): select pressure drop as scheduled on drawings.

D. Binary Temperature Devices.
1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

E. Temperature Sensors.
1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m 2(10 ft 2) of duct cross-section. No element length over 100 ft is allowed.
3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
4. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.

F. Humidity Sensors.
1. Duct and room sensors shall have a sensing range of 20%-80%.
2. Duct sensors shall have a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20%-95% RH and shall be suitable for ambient conditions of 40°C-75°C (40°F-170°F).
4. Humidity sensors shall not drift more than 1% of full scale annually.

G. Flow Meters. Flow-proving switches shall be turbine (water service only), electromagnetic or differential pressure type (air or water service) as shown. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).
1. Turbine/Electromagnetic meters shall have adjustable sensitivity and NEMA 1 enclosure unless otherwise specified.
2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

H. BTU Meters. Onicon BTU System 10 Meter or Owner approved equivalent will be provided at each chilled water flow meter location.

I. Relays.
1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time Delay Relays. Time delay relays in control software is approved but not approved for actual field device installation.

J. Override Timers.
1. Except for being implemented virtually in control software, override timers installed in field are not approved.

K. Current Transmitters.
1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 0-5vdc/0-10vdc output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

L. Current Transformers.
1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

M. Voltage Transmitters.
1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.
2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

N. Voltage Transformers.
1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, shall have built-in fuse protection and surface mounted reset breaker/switch.
2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

O. Power Monitors.
1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.
2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.
3. Building Power Distribution Monitors shall be Shark 200 series with associated current transducers by Electro Industries or equivalent specifically approved by Owner.

4. If Building Power Distribution Monitoring can be achieved by interface to module in Building Distribution Panel then interface must be able to provide real-time monitoring of amps, KW, phase rotation/ voltage on each submeter installed at the main electrical switchboard.

P. Current Switches.
1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

Q. Pressure Transducers.
1. Transducers shall have linear output signal and field-adjustable zero and span.
2. Continuous operating conditions of positive or negative pressure 50% greater than calibrated span shall not damage transducer sensing elements.
3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 0-5vdc/ 0-10vdc output, suitable mounting provisions, and block and bleed valves.
4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi.) Transducer shall have 0-5vdc/ 0-10vdc output, suitable mounting provisions, and 3-valve manifold.

R. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

S. Pressure-Electric (PE) Switches. PE switches shall be UL listed, pilot duty rated (125 VA minimum) or motor control rated, metal or neoprene diaphragm actuated, operating pressure rated for 0-175 kPa (0-25 psig), with calibrated scale minimum setpoint range of 14-125 kPa (2-18 psig).
1. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application.
2. Switches shall be open type (panel-mounted). Exception: Switches shall be enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
3. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

T. Leak Detectors: Leak Detectors shall be Hydro-Temp model N2F12/24AC or Owner approved equivalent.
1. Each detector shall be installed in each space/room housing hydronic mechanical equipment in close proximity to each floor drain at the rate of one (1) per AHU and/or one (1) per drain location on the downhill slope per grade of floor.
2. A detector will also be installed in each Building Electrical Vault following the guidelines previously detailed above.
2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 09 23 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site.
   1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
   2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals. See Section 23 09 23 Article 1.10 (Submittals).

C. Test and Balance.
   1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
   2. Train Test and Balance Contractor to use control system interface tools.
3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.
4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.
5. TAB Contractor will determine mounting locations for all pressure sensors.
6. TAB Contractor will determine setpoints associated with all pressure sensors.

D. Life Safety.
1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls.
2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls.
3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.
4. Fire System Contractor will provide, at minimum, 2 relay modules at location determined by Controls Contractor Panel Location to communicate Building Fire Supervisory and Building Fire Trouble Alarms.

E. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.
1. Communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).
   a. Project Ethernet Cabling Contractor shall provide 2 connection jacks per locations determined by Owner thru Controls contractor.
2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation described in Section 23 09 93 Appendix A regardless of where within the contract documents those products are described.
3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.
### 3.5 FIELD QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.8 (Codes and Standards).

B. Continually monitor field installation for code compliance and workmanship quality.

C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

### 3.6 WIRING

A. Room Thermostat “stub-up” conduit and junction box shall be furnished and installed by the Division 26 Electrician.

B. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.

C. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

D. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

E. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

F. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.

G. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

H. Do not install wiring in raceway containing tubing.

I. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.

J. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

K. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

L. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
M. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

N. Use color-coded conductors throughout.

O. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters. Show all device/equipment panel and miscellaneous enclosure locations on the Project As-Built/Record Drawings and Floor Plans of Graphics Package.

P. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

Q. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

R. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

S. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

T. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

U. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.7 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrester according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths. Splices must be approved by Owner for each instance deemed necessary and must be documented by Installer in Project As-Built/Record Drawings.
3.8 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing and adjacent to room light switch on non-hinge side of door frame. Must seek Owner approval if any inconsistency with this mounting location is deemed necessary. Must seek Owner approval to install any room temperature sensors on exterior walls regardless of Project Construction Drawings.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums, in between cooling and heating coils, and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m² (1 ft²) of coil area.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure.
   1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
   2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
   3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location determined by specific approval from Owner for each project.
   4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
   5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
   6. Mount gauge tees adjacent to air and water differential pressure taps, Install shut-off valves before tee for water gauges.
J. Smoke detectors, freeze-stats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches/safety devices shall require automatic reset. Provide contact for each safety device from relay configuration specifically approved/provided by Owner that allows DDC software to monitor safety switch status.

3.9 FLOW METER INSTALLATION

A. Use correct turbine/electromagnetic meter sizing per associated system pipe diameter.
   1. Use Onicon model F-3100 for all chilled water and steam condensate metering.
   2. Use Onicon model F-1330 for all other hydronic metering (besides domestic water makeup to hot water system) of pipe diameter of 1 inch and less.
   3. Use Onicon model F-1130 for all other hydronic metering (besides domestic water makeup to hot water system) of pipe diameter greater than 1 inch.
   4. Use Istec model 1700 series (1/2” model# 1702) for all domestic water makeup to hot water system locations.

B. Adjust/install flow metering devices according to manufacturer's instructions.

3.10 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.
   1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
   2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
   3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
   4. Provide necessary mounting hardware and linkages for actuator installation.

C. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer.

3.11 WARNING LABELS

A. Affix permanent warning labels to equipment that can be automatically started by the control system.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

   **CAUTION**
   This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.
B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

   CAUTION
   This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.

B. Label pneumatic tubing at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show instrument or item served.

D. Label control panels (externally with controlled system name/description and internally with hardware address designation) with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

F. Label room sensors related to terminal boxes or valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

H. Label identifiers shall match record documents.

3.13 PROGRAMMING

A. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. See Section 23 09 93 (Sequences of Operation). If character limitations or space restrictions make it advisable to shorten the name, the abbreviations given in Appendix B to Section 23 09 93 may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.

B. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
   1. Application Programming. Provide application programming that adheres to sequences of operation specified in Section 23 09 93. Program documentation or comment statements shall reflect language used in sequences of operation.
   2. System Programming. Provide system programming necessary for system operation.
C. Operator Interface.
   1. Standard Graphics. Provide graphics as specified in Section 23 09 23 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List in Section 23 09 93. Point information on graphics shall dynamically update.
   2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in Section 23 09 23.

3.14 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.
   1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.
   2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
   3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
   4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
   5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
   6. Prepare a log documenting startup testing and commissioning of each input and output device, with technician's initials certifying each device has been tested and calibrated.
   7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning. Have trending graphs available at will for any control loops involving a PID to prove operation of all associated variables on the same graph to be within acceptable efficiency guidelines.
   8. Alarms and Interlocks.
      a. Check each alarm with an appropriate signal at a value that will trip the alarm.
      b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
      c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.15 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Article 3.17 (Control System Checkout and Testing). Provide Engineer with log documenting completion of startup tests.
1. Engineer will be present to observe and review system demonstration. Notify Engineer at least 10 days before system demonstration begins.

2. Demonstration shall follow process submitted and approved under Section 23 09 23 Article 1.10 (Submittals). Complete approved checklists and forms for each system as part of system demonstration.

3. Demonstrate actual field operation of each sequence of operation as specified in Section 23 09 93. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation.

4. Demonstrate compliance with Section 23 09 23 Part 1 (System Performance).

5. Demonstrate compliance with sequences of operation through each operational mode.

6. Demonstrate complete operation of operator interface.

7. Demonstrate each of the following.
   a. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.

   b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand-limiting setpoint, and status of setpoints and other affected equipment parameters.

   c. Building fire alarm system interface.

   d. Trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation in Section 23 09 93. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs as specified in Section 23 09 23 Article 2.3 Paragraph E.11 (Trend Configuration).

8. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance.

1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.

2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Section 23 09 23 Article 1.10 (Submittals).
3.16 CLEANING

A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.

B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.17 TRAINING

A. Provide training for a designated staff of Owner’s representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Training shall enable students to accomplish the following objectives.
   1. Proficiently operate system
   2. Understand control system architecture and configuration
   3. Understand DDC system components
   4. Understand system operation, including DDC system control and optimizing routines (algorithms)
   5. Operate workstation and peripherals
   6. Log on and off system
   7. Access graphics, point reports, and logs
   8. Adjust and change system setpoints, time schedules, and holiday schedules
   9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
   10. Understand system drawings and Operation and Maintenance manual
   11. Understand job layout and location of control components
   12. Access data from DDC controllers
   13. Operate portable operator's terminals
   14. Create and change system graphics
   15. Create, delete, and modify alarms, including configuring alarm reactions
   16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
   17. Configure and run reports
   18. Add, remove, and modify system’s physical points
   19. Create, modify, and delete application programming
   20. Add operator interface stations
   21. Add a new controller to system
   22. Download firmware and advanced applications programming to a controller
   23. Configure and calibrate I/O points
   24. Maintain software and prepare backups
   25. Interface with job-specific, third-party operator software
   26. Add new users and understand password security procedures

C. Divide presentation of objectives into three sessions (1-13, 14-23, and 24-26). Participants will attend one or more of sessions, depending on knowledge level required.
   1. Day-to-day Operators (objectives 1-13)
2. Advanced Operators (objectives 1-13 and 14-23)
3. System Managers and Administrators (objectives 1-13 and 24-26)

D. Provide course outline and materials according to Section 23 09 23 Article 1.10 (Submittals). Provide one copy of training material per student.

E. Instructors shall be factory-trained and experienced in presenting this material.

F. Perform classroom training using a network of working controller devices representative of installed hardware.

END OF SECTION 15911
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## SHU BAS Master Points List

**Input/Output Point Summary**

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<th>AO</th>
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<td>Terminal Unit Points</td>
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**Additional Information:**

- Terminal Unit Points:
  - 0 Total Terminal Unit Points
  - 9 Total AHU and Paint Points
  - 101 Total Project Points

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Last Revision: June 2019

Building Construction and Materials

B-4M - 3
Section 23 09 00
Instrumentation and Control for HVAC

SMU BAS Master Sequence of Operations
VAV/Parallel FPB - AHU Building

Prepared By:
SMU Building Automation Systems, Systems Administrator
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

1.1 VAV-AHU (typical)

Run Conditions - Requested:
The unit shall run whenever:

- Any zone is occupied.
- OR a definable number of unoccupied zones need heating or cooling.

Freeze Protection:
The unit shall shut down and generate an alarm upon receiving a freezestat status.

High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving an high static shutdown signal.

Low Static Shutdown:
The unit shall shut down and generate an alarm upon receiving an low static shutdown signal.

Return Air Smoke Detection:
The unit shall shut down and generate an alarm upon receiving a return air smoke detector status.

Supply Air Smoke Detection:
The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

AHU Optimal Start:
The unit shall start prior to scheduled occupancy based on the time necessary for the zones to reach their occupied setpoints. The start time shall automatically adjust based on changes in outside air temperature and zone temperatures.

Demand Limiting - Setpoint Adjust:
To lower power consumption, the supply air temperature setpoint shall automatically relax (raised for cooling; lowered for heating) when the facility power consumption exceeds definable thresholds. The amount of relaxation shall be accomplished by both of the following methods:

- The supply air temperature setpoint shall relax by 2°F (adj.) for each demand threshold exceeded.
- The setpoints in the zones supplied by this unit shall be relaxed as specified in the Sequence of Operations for the zones. This shall in turn relax the unit's supply air temperature setpoint by a user definable amount.

All setpoints shall automatically return to their previous settings when the facility power consumption drops below the thresholds, per operator command.

Supply Fan:
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.
Alarms shall be provided as follows:

- Supply Fan Failure: Commanded on, but the status is off.
- Supply Fan in Hand: Commanded off, but the status is on.
- Multiple Fan Systems – All Fan’s Status’ will be individually monitored

Supply Air Duct Static Pressure Control:
The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below a TAB furnished minimum % (adj.).
The static pressure setpoint shall be reset based on zone cooling requirements.

- The initial duct static pressure setpoint shall be TAB furnished minimum (adj.).
- As cooling demand increases, the setpoint shall incrementally reset up to a maximum of TAB furnished minimum (adj.).
- As cooling demand decreases, the setpoint shall incrementally reset down to a minimum of TAB furnished minimum (adj.).

Alarms shall be provided as follows:

- High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.
- Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
- Supply Fan VFD Fault.

Return Fan:
The return fan shall run whenever the supply fan runs.

Alarms shall be provided as follows:

- Return Fan Failure: Commanded on, but the status is off.
- Return Fan in Hand: Commanded off, but the status is on.
- Return Fan VFD Fault.

Building Static Pressure Control:
The controller shall measure building static pressure and modulate the return fan VFD speed to maintain a building static pressure setpoint of 0.05in H2O (adj.).
The return fan VFD speed shall not drop below 20% (adj.).

Alarms shall be provided as follows:

- High Building Static Pressure: If the building air static pressure is 25% (adj.) greater than setpoint.
- Low Building Static Pressure: If the building air static pressure is 25% (adj.) less than setpoint.

Supply Air Temperature Setpoint - Optimized:
The controller shall monitor the supply air temperature and shall maintain a supply air temperature setpoint reset based on zone cooling requirements.
The supply air temperature setpoint shall be reset based on zone cooling requirements as follows:

- The initial supply air temperature setpoint shall be 55°F (adj.).
- As cooling demand increases, the setpoint shall incrementally reset down to a minimum of 53°F (adj.).
- As cooling demand decreases, the setpoint shall incrementally reset up to a maximum of 65°F (adj.).

**Cooling Coil Valve:**
The controller shall measure the supply air temperature and modulate the cooling coil valve to maintain its cooling setpoint.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 60°F (adj.).
- AND the economizer (if present) is disabled or fully open.
- AND the supply fan status is on.
- AND the heating (if present) is not active.

The cooling coil valve shall open to 50% (adj.) whenever the freezestat (if present) is on.

Alarms shall be provided as follows:

- High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

**Low Supply Air Temperature Alarm:**
The controller shall alarm if the supply air temperature is less than 45°F (adj.).

**Economizer:**
The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

The economizer shall be enabled whenever:

- Outside air temperature is less than 65°F (adj.).
- AND the outside air enthalpy is less than 22Btu/lb (adj.)
- AND the outside air temperature is less than the return air temperature.
- AND the outside air enthalpy is less than the return air enthalpy.
- AND the supply fan status is on.

The economizer shall close whenever:

- Mixed air temperature drops from 40°F to 39°F (adj.)
- OR the freezestat (if present) is on.
- OR on loss of supply fan status.
The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

**Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control:**
When in the occupied mode, the controller shall monitor zone CO2 levels served by this air handling unit. The controller shall take the highest zone CO2 level and modulate the outside air dampers open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of 1000 ppm (adj.).

Alarms shall be provided as follows:

- **High Zone Carbon Dioxide Concentration:** If the highest zone CO2 concentration is greater than 1200 ppm (adj.).

**Dehumidification:**
The controller shall measure the return air humidity and override the cooling sequence to maintain return air humidity at or below 65% rh (adj.). Dehumidification shall be enabled whenever the supply fan status is on.

**Final Filter Differential Pressure Monitor:**
The controller shall monitor the differential pressure across the final filter.

Alarms shall be provided as follows:

- **Final Filter Change Required:** Final filter differential pressure exceeds a user definable limit (adj.).

**Mixed Air Temperature:**
The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).

Alarms shall be provided as follows:

- **High Mixed Air Temp:** If the mixed air temperature is greater than 90°F (adj.).
- **Low Mixed Air Temp:** If the mixed air temperature is less than 45°F (adj.).

**Return Air Temperature:**
The controller shall monitor the return air temperature and use as required for setpoint control or economizer control (if present).

**Supply Air Temperature:**
The controller shall monitor the supply air temperature.

Alarms shall be provided as follows:
- High Supply Air Temp: If the supply air temperature is greater than 75°F (adj.).
- Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

**Leak Detector:**

The controller shall monitor leak detector status.

Alarms shall be provided as follows:

- System shall alarm upon leak detection and be configurable to text and/or email (at Owner’s discretion) either individually or with groups setup to notify personnel.

**Safety Circuit Wiring:**

The Safety Circuit will follow this template below. Any adjustment by vendor must be approved prior to implementation by Owner.

1.2 Variable Air Volume - Terminal Unit (typical)

**Run Conditions - Scheduled:**

The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain
  - A 74°F (adj.) cooling setpoint
  - A 70°F (adj.) heating setpoint.
- Unoccupied Mode (night setback): The unit shall maintain
- A 85°F (adj.) cooling setpoint.
- A 55°F (adj.) heating setpoint.

If occupancy sensor is used, use these parameters in addition too

- Unoccupied Mode (occupancy sensor): The unit shall maintain
  - A 78°F (adj.) cooling setpoint.
  - A 65°F (adj.) heating setpoint.

Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time (120 min adj.). At the expiration of this time, control of the unit shall automatically return to the schedule.

Variable Volume Terminal Unit - Flow Control:
The unit shall maintain zone setpoints by controlling the airflow through one of the following:

Occupied:

- When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
- When the zone temperature is less than the cooling setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.).

Unoccupied:

- When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.).
- When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.

Reheating Coil Valve:
The controller shall measure the zone temperature and modulate the reheating coil valve open on dropping temperature to maintain its heating setpoint.

Discharge Air Temperature:
The controller shall monitor the discharge air temperature.

1.3 Fan Coil Unit (typical)

Run Conditions - Scheduled:
The unit shall run according to a user definable time schedule in the following modes:
- Occupied Mode: The unit shall maintain
  - A 73°F (adj.) cooling setpoint
  - A 71°F (adj.) heating setpoint.
- Unoccupied Mode (night setback): The unit shall maintain
  - A 85°F (adj.) cooling setpoint.
  - A 55°F (adj.) heating setpoint.

Alarms shall be provided as follows:

- High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Fan:
The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

Cooling Coil Valve:
The controller shall measure the zone temperature and modulate the cooling coil valve to maintain its cooling setpoint.

The cooling shall be enabled whenever:

- AND the zone temperature is above cooling setpoint.
- AND the fan is on.

The cooling coil valve shall open whenever the freezestat (if present) is on.

Discharge Air Temperature:
The controller shall monitor the discharge air temperature.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
1.4 Exhaust Fan - Toilet/General (typical)

Run Conditions - Interlocked:
The fan(s) Toilet/General EF shall be interlocked to run whenever (associated) Air Handling Unit runs unless shutdown on safeties.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.

1.6 Exhaust Fan - Crawl Space (typical)

Run Conditions: The fan shall run according space humidity and temperature set point

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.

1.7 Steam to Hot Water Converter (typical) (Hydronic)

Heat Exchanger System Run Conditions:
The heat exchanger system shall be enabled to run under set point control.

Hot Water Pump Lead/Lag Operation:
The two hot water pumps shall operate in a lead/lag fashion.

- The lead pump shall run first.
- On failure of the lead pump, the lag pump shall run and the lead pump shall alarm.
- On decreasing hot water differential pressure, the lag pump shall stage on and run in unison with the lead pump to maintain hot water differential pressure setpoint.

The designated lead pump shall rotate upon one of the following conditions (user selectable):

- manually through a software switch
- if pump runtime (adj.) is exceeded
Alarms shall be provided as follows:

- **Hot Water Pump 1**
  - Failure: Commanded on, but the status is off.
  - Running in Hand: Commanded off, but the status is on.
  - VFD Fault.

- **Hot Water Pump 2**
  - Failure: Commanded on, but the status is off.
  - Running in Hand: Commanded off, but the status is on.
  - VFD Fault.

**Hot Water Differential Pressure Control:**
The controller shall measure hot water differential pressure and modulate the hot water pump VFDs in sequence to maintain its hot water differential pressure setpoint.

The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

The controller shall modulate hot water pump speeds to maintain a hot water differential pressure of 12lb/in² (adj.). The VFDs minimum speed shall not drop below 33% or 20 Hz (adj.).

On dropping hot water differential pressure, the VFDs shall stage on and run to maintain setpoint as follows:

- The controller shall modulate the lead VFD to maintain setpoint.
- If the lead VFD speed is greater than a setpoint of 90% (adj.) for 5 min. (adj.), the lag VFD shall stage on.
- The lag VFD shall ramp up to match the lead VFD speed and then run in unison with the lead VFD to maintain differential pressure setpoint.

On rising hot water differential pressure, the VFDs shall stage off as follows:

- If the VFDs speeds drops back to 60% (adj.) for 5 min. (adj.) below setpoint, the lag VFD shall stage off.
- The lead VFD shall continue to run to maintain setpoint.

Alarms shall be provided as follows:

- High Hot Water Differential Pressure: If 25% (adj.) greater than setpoint.
- Low Hot Water Differential Pressure: If 25% (adj.) less than setpoint.

**Hot Water Supply Temperature Setpoint Reset:**
The hot water supply temperature setpoint shall reset using a trim and respond algorithm based on heating requirements.

As the facility's hot water valves open beyond a user definable threshold (90% open, typ.), the setpoint shall reset to a higher value (adj.). Once the hot water coils are satisfied (valves closing) then the setpoint shall gradually lower over time to reduce heating energy use.
Alarms shall be provided as follows:

- High Hot Water Supply Temp: If greater than 200°F (adj.).
- Low Hot Water Supply Temp: If less than 100°F (adj.).

**Heat Exchanger Steam Valve - Hot Water Control:**
The controller shall measure the hot water supply temperature and modulate the steam valve to maintain its setpoint.

The steam valve shall be enabled whenever:

- The heat exchanger is called to run.
- AND hot water supply temperature is below setpoint.

The steam valve shall close whenever the hot water supply temperature rises above 200°F (adj.).

**1.8 Chilled Water Loop Pump (typical)**

**Chilled Water Pump System - Run Conditions:**
The chilled water pumps shall be enabled whenever:

- A definable number of chilled water coils need cooling.
- AND the outside air temperature is greater than 54°F (adj.).

To prevent short cycling, the chilled water pump system shall run for and be off for minimum adjustable times (both user definable).

The pumps shall run for freeze protection anytime the outside air temperature is less than 38°F (adj.).

**Chilled Water Pump:**
The chilled water pump shall run anytime it is requested to run. The chilled water pump shall also run for freeze protection whenever the outside air temperature is less than a user definable setpoint (adj.).

The chilled water pump shall have:

- A user adjustable delay on start.
- AND a user adjustable delay on stop.

The delay times shall be set appropriately to allow for orderly chilled water system start-up, shutdown and sequencing.

Alarms shall be provided as follows:

- Chilled Water Pump Failure: Commanded on, but the status is off.
- Chilled Water Pump Running in Hand: Commanded off, but the status is on.
- Chilled Water Pump VFD Fault.
Chilled Water Differential Pressure Control:
The controller shall measure chilled water differential pressure and modulate the chilled water pump VFD to maintain its chilled water differential pressure setpoint. The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

The controller shall modulate chilled water pump speed to maintain a chilled water differential pressure of 12lb/in² (adj.). The VFD minimum speed shall not drop below 33% or 20 HZ(adj.).

Alarms shall be provided as follows:

- High Chilled Water Differential Pressure: If the chilled water differential pressure is 25% (adj.) greater than setpoint.
- Low Chilled Water Differential Pressure: If the chilled water differential pressure is 25% (adj.) less than setpoint.

Chilled Water Temperature Monitoring:
The following temperatures shall be monitored:

- Chilled water supply.
- Chilled water return.

Alarms shall be provided as follows:

- High Chilled Water Supply Temp: If the chilled water supply temperature is greater than 55°F (adj.).
- Low Chilled Water Supply Temp: If the chilled water supply temperature is less than 38°F (adj.).

1.9 Hot Water Loop Pumps (typical)

Hot Water Pump Run Conditions:
The hot water pumps shall be enabled whenever:

- A definable number of hot water coils need heating.

The pumps shall run for freeze protection anytime outside air temperature is less than 38°F (adj.).

To prevent short cycling, the pump shall run for a minimum time and be off for a minimum time (both user adjustable).
Hot Water Pump Lead/Lag Operation:
The two variable speed hot water pumps shall operate in a lead/lag fashion.

- The lead pump shall run first.
- On failure of the lead pump, the lag pump shall run and the lead pump shall alarm.
- On decreasing hot water differential pressure, the lag pump shall stage on and run in unison with the lead pump to maintain hot water differential pressure setpoint.

The designated lead pump shall rotate upon one of the following conditions (user selectable):

- manually through a software switch
- if pump runtime (adj.) is exceeded

Alarms shall be provided as follows:

- Hot Water Pump 1
  - Failure: Commanded on, but the status is off.
  - Running in Hand: Commanded off, but the status is on.
  - VFD Fault.
- Hot Water Pump 2
  - Failure: Commanded on, but the status is off.
  - Running in Hand: Commanded off, but the status is on.
  - VFD Fault.

Hot Water Differential Pressure Control:
The controller shall measure hot water differential pressure and modulate the hot water pump VFDs in sequence to maintain its hot water differential pressure setpoint.

The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

The controller shall modulate hot water pump speeds to maintain a hot water differential pressure of 12lb/in² (adj.). The VFDs minimum speed shall not drop below 33% or 20 Hz(adj.).

On dropping hot water differential pressure, the VFDs shall stage on and run to maintain setpoint as follows:

- The controller shall modulate the lead VFD to maintain setpoint.
- If the lead VFD speed is greater than a setpoint of 90% (adj.), the lag VFD shall stage on.
- The lag VFD shall ramp up to match the lead VFD speed and then run in unison with the lead VFD to maintain setpoint.

On rising hot water differential pressure, the VFDs shall stage off as follows:

- If the VFDs speeds drops back to 60% (adj.) below setpoint, the lag VFD shall stage off.
- The lead VFD shall continue to run to maintain setpoint.

Alarms shall be provided as follows:
- High Hot Water Differential Pressure: If 25% (adj.) greater than setpoint.
- Low Hot Water Differential Pressure: If 25% (adj.) less than setpoint.

Hot Water Temperature Monitoring:
The following temperatures shall be monitored:

- Hot water supply.
- Hot water return.

Alarms shall be provided as follows:

- High Hot Water Supply Temp: If the hot water supply temperature is greater than 200°F (adj.).
- Low Hot Water Supply Temp: If the hot water supply temperature is less than 100°F (adj.).

1.10 BTU Meter (typical)

BTU Meter:
The controller shall monitor the BTU meter for energy consumption on a continual basis. These values shall be made available to the system at all times.

Alarm shall be generated as follows:

- Invalid Reading: Sensor reading indicates an invalid value from the BTU meter.

Peak Demand History:
The controller shall monitor and record the peak (high and low) demand readings from the BTU meter. Peak readings shall be recorded on a daily, month-to-date, and year-to-date basis.

Usage History:
The controller shall monitor and record BTU meter readings so as to provide an energy consumption history. Usage readings shall be recorded on a daily, month-to-date, and year-to-date basis.

1.11 Electric Meter (typical of 1)

Electric Meter:
The controller shall monitor the electric meter for electric consumption on a continual basis. These values shall be made available to the system at all times.

Alarm shall be generated as follows:

- Meter Alarm: Sensor reading indicates an invalid value from the electric meter.

Peak Demand History:
The controller shall monitor and record the peak (high and low) demand readings from the electric meter. Peak readings shall be recorded on a daily, month-to-date, and year-to-date basis.
Usage History:
The controller shall monitor and record electric meter readings so as to provide a power consumption history. Usage readings shall be recorded on a daily, month-to-date, and year-to-date basis.

Demand Levels:
The controller shall set the system demand level (adj.) based on the current power consumption readings from the electric meter. There shall be six daily time periods in which the demand shall be adjusted on three levels. These demand levels shall be available for facility equipment to utilize for demand limiting.

- Demand Level 1: Power consumption has exceeded the first demand level threshold (adj.).
- Demand Level 2: Power consumption has exceeded the second demand level threshold (adj.).
- Demand Level 3: Power consumption has exceeded the third demand level threshold (adj.).

1.12 Indoor Lighting (typical)

Run Conditions - Scheduled:
The lighting shall be turned on or off based on a user definable schedule.

Occupant Override:
A timed local override control will allow an occupant to override the schedule and turn the lighting on for an adjustable period of time. At the expiration of this time, control of the lighting will automatically return to the schedule.

Warning Flash:
The output will cycle off (flash) 5 times (adj) to warn occupants when the lights are about to turn off. This flashing will occur 5 minutes (adj) before the the lights turn off.

Alarm shall be provided as follows:

- Output Runtime Exceeded: Lighting runtime exceeds a user definable limit (adj.).

1.13 Outdoor Lighting (typical of 1)

Run Conditions:
The lighting output shall turn on and off based upon the local sunrise and sunset times. The transitions shall be configurable as follows:

Output turns OFF (adj) at 30 minutes (adj) BEFORE (adj) sunrise.

Output turns ON (adj) at 30 minutes (adj) AFTER (adj) sunset.
## 1.14 Point Summary

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<td>Return Air</td>
<td>Temperature</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
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<td>↓</td>
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<tr>
<td>Return Air Damper</td>
<td>Modulate</td>
<td>1</td>
<td>1</td>
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</tr>
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<td>Modulate</td>
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<td>1</td>
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<td>Relief Air Damper</td>
<td>Modulate</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Outside Air Damper</td>
<td>Modulate</td>
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<td>1</td>
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</tr>
<tr>
<td>Outside Air Damper End Switch</td>
<td>Modulate</td>
<td>1</td>
<td>1</td>
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<td>Filter Status</td>
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<tr>
<td>Chill Water Valve</td>
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<td>1</td>
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<tr>
<td>Smoke Detector</td>
<td>Alarm Status</td>
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<td>1</td>
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<tr>
<td>Smoke Detector</td>
<td>Interlock</td>
<td>2</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Safety Cutout</td>
<td>EMS Lockout</td>
<td>1</td>
<td>1</td>
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</table>

**Building Construction and Materials**  
**B-4P - 17**
### Fan Coil Unit (Typ)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Start/Stop</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fan Status</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chilled Water Valve Modulate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Space Temperature</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Supply Air Temperature</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lighting Occ Sens (POB, where app)</td>
<td>Provided by others</td>
<td>Sensor provided by others</td>
</tr>
<tr>
<td>Emergency Drain Pan (where app)</td>
<td>Detector 1</td>
<td>WD-1B</td>
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### VAV Box (Typ)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value 1</th>
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<tbody>
<tr>
<td>Space Temperature</td>
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</tr>
<tr>
<td>Override Request Status</td>
<td>1</td>
</tr>
<tr>
<td>Lighting Occ Sens (POB, where app)</td>
<td>Provided by others</td>
</tr>
<tr>
<td>Setpoint Adjust Increase/Decrease</td>
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</tr>
<tr>
<td>Reheat/Supply Air Temperature</td>
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</tr>
<tr>
<td>Reheat Valve Modulate</td>
<td>1</td>
</tr>
<tr>
<td>Primary Air CFM</td>
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</tr>
<tr>
<td>VAV Damper Modulate</td>
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<td>LCD/LED Thermostat w/setpoint adjustment and override control</td>
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### Parrallal FPB Box (Typ)

<table>
<thead>
<tr>
<th>Feature</th>
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<tbody>
<tr>
<td>Space Temperature</td>
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</tr>
<tr>
<td>Override Request Status</td>
<td>1</td>
</tr>
<tr>
<td>Lighting Occ Sens (POB, where app)</td>
<td>Provided by others</td>
</tr>
<tr>
<td>Setpoint Adjust Increase/Decrease</td>
<td>1</td>
</tr>
<tr>
<td>Reheat/Supply Air Temperature</td>
<td>1</td>
</tr>
<tr>
<td>Reheat Valve Modulate</td>
<td>1</td>
</tr>
<tr>
<td>Primary Air CFM</td>
<td>1</td>
</tr>
<tr>
<td>VAV Damper Modulate</td>
<td>1</td>
</tr>
<tr>
<td>LCD/LED Thermostat w/setpoint adjustment and override control</td>
<td>1</td>
</tr>
<tr>
<td>onboard velocity transducer</td>
<td>1</td>
</tr>
<tr>
<td>integral actuator</td>
<td>1</td>
</tr>
<tr>
<td>Fan Start/Stop</td>
<td>1</td>
</tr>
<tr>
<td>Fan Status</td>
<td>1</td>
</tr>
<tr>
<td>Fan Speed</td>
<td>1</td>
</tr>
<tr>
<td>Fan Speed</td>
<td>1</td>
</tr>
</tbody>
</table>
APPENDIX A: Glossary of Terms

Terms used within the Specification Text:

- **Advanced Application Controller (AAC):**
  
  A fully programmable control module. This control module may be capable of some of the advanced features found in Building Controllers (storing trends, initiating read and write requests, etc.) but it does not serve as a master controller. Advanced Application Controllers may reside on either the Ethernet/IP backbone or on a subnet.

- **Application Specific Controller (ASC):**
  
  A pre-programmed control module which is intended for use in a specific application. ASCs may be configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors' architectures ASCs do not store trends or schedules but instead rely upon a Building Controller to provide those functions.

- **BACnet/IP:**
  
  An approved BACnet network type which uses an Ethernet carrier and IP addressing.

- **BACnet MS/TP:**
  
  An approved BACnet network type which uses a Master-Slave Token Passing configuration. MS/TP networks are unique to BACnet and utilize EIA485 twisted pair topology running at 9600 to 76,800 bps.

- **Building Controller (BC):**
  
  A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically this controller is located on the Ethernet/IP backbone of the SMU BMS Network. In many vendors' architectures a Building Controller will serve as a master controller, storing schedules and trends for controllers on a subnet underneath the Building Controller.

- **Direct Digital Control (DDC):**
  
  A control system in which a digital computer or microprocessor is directly connected to the valves, dampers, and other actuators which control the system, as opposed to indirectly controlling a system by resetting setpoints on an analog pneumatic or electronic controller.
• **PICS - Protocol Implementation Conformance Statement:**

A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device.

• **Smart Actuator (SA):**

An actuator which is controlled by a network connection rather than a binary or analog signal. (0-10v, 4-20mA, relay, etc.)

• **Smart Sensor (SS):**

A sensor which provides information to the BAS via network connection rather than a binary or analog signal. (0-10000 ohm, 4-20mA, dry contact, etc.)

• **Web services:**

Web services are a standard method of exchanging data between computer systems using the XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services can be used at any level within a Building Automation System (BAS), but most commonly they are used to transfer data between BAS using different protocols or between a BAS and a non-BAS system such as a tenant billing system or a utility management system.

**Terms used within the Sequences of Operation:**

• **adj.**

Adjustable by the end user, through the supplied user interface.

• **AI, AO, etc. (Column Headings on Points List)**

AI = Analog Input. A physical input to the control module.
AO = Analog Output. A physical output from the control module.
AV = Analog Value. An intermediate (software) point that may be editable or read-only. Editable AVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only AVs are typically used to display the status of a control operation.
BI = Binary Input. A physical input to the control module.
BO = Binary Output. A physical output from the control module.
BV = Binary Value. An intermediate (software) point that may be editable or read-only. Editable BVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only BVs are typically used to display the status of a control operation.
Sched = Schedule. The control algorithm for this equipment shall include a user editable schedule.
Trend. The control system shall be configured to collect and display a trend log of this object. The trending interval shall be no less than one sample every 5 minutes. (Change of Value trending, where a sample is taken every time the value changes by more than a user-defined minimum, is an acceptable alternative.)
Alarm. The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the Sequence of Controls.
Note: If the specifications require use of the BACnet protocol, all of the above shall be provided as BACnet objects.

- **KW Demand Limiting:** *

  An energy management strategy that reduces energy consumption when a system's electric power meter exceeds an operator-defined threshold.

  When power consumption exceeds defined levels, the system automatically adjust setpoints, de-energizes low priority equipment, and takes other pre-programmed actions to avoid peak demand charges. As the demand drops, the system restores loads in a predetermined manner.

- **Occupant Override Switch, or Timed Local Override:**

  A control option that allows building occupants to override the programmed HVAC schedule for a limited period of time.

  When the override time expires, the zone returns to its unoccupied state.

- **Occupant Setpoint Adjustment:**

  A control option that allows building occupants to adjust - within limits set by the HVAC control system - the heating and cooling setpoints of selected zones. Typically the user interface for this function is built into the zone sensor.

- **Optimal Start-Up:** *

  A control strategy that automatically starts an HVAC system at the latest possible time yet ensures comfort conditions by the time the building becomes occupied.

  In a typical implementation, a controller measures the temperature of the zone and the outside air. Then, using design heating or cooling capacity at the design outside air temperature, the system computes how long a unit must run at maximum capacity to bring the zone temperature to its occupied setpoint.

  The optimal start algorithm often includes a self-learning feature to adjust for variations from design capacity.

  A distributed system must use Run on Request with Optimal Start. (See below.)

- **Requested, or Run on Request:** *

  A control strategy that optimizes the runtime of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service. Source equipment runs only when needed, not on a fixed schedule.
The source equipment runs when one or more receiving units request its services. An operator determines how many requests are required to start the source equipment.

For example, if all the zones in a building are unoccupied and the zone terminal units do not need heating or cooling, the AHU will shut down. However, if a zone becomes occupied or needs cooling, the terminal unit will send a run request to the AHU to initiate the start-up sequence. If this AHU depends on a central chiller, it can send a run request to the chiller.

The run on request algorithm also allows an operator to schedule occupancy for individual zones based on the needs of the occupants without having to adjust the schedules of related AHUs and chillers.

- **Trim and Respond, or Setpoint Optimization:** *

A control strategy that optimizes the setpoint of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service.

The source unit communicates with receiving units to determine heating, cooling, and other requirements, and then adjusts its setpoint.

For example, if all zones are comfortable and do not request cooling, the AHU will gradually increase (trim) its supply air setpoint. When a zone requests cooling, the AHU responds by dropping its setpoint. The more zones that request cooling, the more it drops the setpoint. The AHU repeats this process throughout the day to keep zones cool, but with a supply air setpoint that is no cooler than necessary.

**Contracting Terms:**

- **Furnished or Provided:**

  The act of supplying a device or piece of equipment as required meeting the scope of work specified and making that device or equipment operational. All costs required to furnish the specified device or equipment and make it operational are borne by the division specified to be responsible for providing the device or equipment.

- **Install or Installed:**

  The physical act of mounting, piping or wiring a device or piece of equipment in accordance with the manufacturer's instructions and the scope of work as specified. All costs required to complete the installation are borne by the division specified to include labor and any ancillary materials.

- **Interface:**

  The physical device required to provide integration capabilities from an equipment vendor's product to the control system. The equipment vendor most normally furnishes the interface device. An example of an interface is the chilled water temperature reset interface card
provided by the chiller manufacturer in order to allow the control system to integrate the chilled water temperature reset function into the control system.

- **Integrate:**

  The physical connections from a control system to all specified equipment through an interface as required to allow the specified control and monitoring functions of the equipment to be performed via the control system.
APPENDIX B: Abbreviations

The following abbreviations may be used in graphics, schematics, point names, and other UI applications where space is at a premium.

AC - Air Conditioning
ACU - Air Conditioning Unit
AHU - Air Handling Unit
AI - Analog Input
AO - Analog Output
AUTO - Automatic
AUX - Auxiliary
BI - Binary Input
BO - Binary Output
C - Common
CHW - Chilled Water
CHWP - Chilled Water Pump
CHWR - Chilled Water Return
CHWS - Chilled Water Supply
COND - Condenser
CW - Condenser Water
CWP - Condenser Water Pump
CWR - Condenser Water Return
CWS - Condenser Water Supply
DA - Discharge Air
EA - Exhaust Air
EF - Exhaust Fan
EVAP - Evaporators
FCU - Fan Coil Unit
HOA - Hand / Off / Auto
HP - Heat Pump
HRU - Heat Recovery Unit
HTEX - Heat Exchanger
HW - Hot Water
HWP - Hot Water Pump
HWR - Hot Water Return
HWS - Hot Water Supply
MAX - Maximum
MIN - Minimum
MISC - Miscellaneous
NC - Normally Closed
NO - Normally Open
OA - Outdoor Air
PIU - Powered Induction Unit
RA - Return Air
RF - Return Fan
RH - Relative Humidity
RTU - Roof-top Unit
SA - Supply Air
SF - Supply Fan
SP - Static Pressure
TEMP - Temperature
UH - Unit Heater
UV - Unit Ventilator
VAV - Variable Air Volume
VVTU - Variable Volume Terminal Unit
W/ - with
W/O - without
WSHP - Water Source Heat Pump
1. GENERAL

1.1. This specification covers the electrical and mechanical characteristics of 45-10,000 kVA Three-Phase Step-Down Pad-Mounted Distribution Transformers. KVA ratings for transformers with secondary voltages not exceeding 700V are 45-3,750 kVA, while KVA ratings for transformers with secondary voltages greater than 700V are 1,000-10,000 kVA. Product is per Cooper Power System’s catalog section 210-12.

1.2. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI and NEMA standards.

C57.12.00 - IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.


C57.12.28 - Pad-Mounted Equipment - Enclosure Integrity.


C57.91 - Guide for Loading Mineral-Oil-Immersed Transformers.

2. RATINGS

2.1. The transformer shall be designed in accordance with this specification and the kVA rating shall be 45, 75, 112.5, 150, 225, 300, 500, 750, 1000, 1500, 2000, 2500, 3000, 3750, 5000, 7500, 10,000 (range may also be specified).

2.2. The primary voltage, configuration, and the basic lightning impulse insulation level (BIL) shall be __________, {make a selection from Table 1} Dual voltages are also available.

PART 1 - Table 1 - Transformer Voltage Ratings (volts), Configuration, and BIL Levels
<table>
<thead>
<tr>
<th>Primary Voltage</th>
<th>BIL (kV)</th>
<th>Secondary Voltage</th>
<th>BIL (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2400 Delta</td>
<td>60</td>
<td>208Y/120</td>
<td></td>
</tr>
<tr>
<td>4160 Delta</td>
<td>60</td>
<td>480Y/277</td>
<td>All 30 kV</td>
</tr>
<tr>
<td>4800 Delta</td>
<td>60</td>
<td>575Y/332</td>
<td></td>
</tr>
<tr>
<td>7200 Delta</td>
<td>75</td>
<td>600Y/347</td>
<td></td>
</tr>
<tr>
<td>12000 Delta</td>
<td>95</td>
<td>690Y/398</td>
<td></td>
</tr>
<tr>
<td>12470 Delta</td>
<td>95</td>
<td>240 Delta</td>
<td></td>
</tr>
<tr>
<td>13200 Delta</td>
<td>95</td>
<td>480 Delta</td>
<td></td>
</tr>
<tr>
<td>13800 Delta</td>
<td>95</td>
<td>240 Delta with 120 Mid-Tap</td>
<td></td>
</tr>
<tr>
<td>14400 Delta</td>
<td>95</td>
<td>Tap</td>
<td></td>
</tr>
<tr>
<td>16430 Delta</td>
<td>125</td>
<td>480 Delta with 240 Mid-Tap</td>
<td></td>
</tr>
<tr>
<td>34500 Delta</td>
<td>150</td>
<td>Tap</td>
<td></td>
</tr>
<tr>
<td>43800 Delta</td>
<td>250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4160GrdY/2400</td>
<td>60</td>
<td>See left column for</td>
<td>voltages over 700 V</td>
</tr>
<tr>
<td>8320GrdY/4800</td>
<td>75</td>
<td></td>
<td></td>
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<tr>
<td>12470GrdY/7200</td>
<td>95</td>
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<tr>
<td>13200GrdY/7620</td>
<td>95</td>
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<td></td>
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<tr>
<td>13800GrdY/7970</td>
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<td></td>
</tr>
<tr>
<td>22860GrdY/13200</td>
<td>125</td>
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<td></td>
</tr>
<tr>
<td>23900GrdY/13800</td>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24940GrdY/14400</td>
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<tr>
<td>34500GrdY/19920</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43800GrdY/25300</td>
<td>250</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. For complete connector rating, see ANSI/IEEE 386.
2. Transformers are suitable for connectors with phase-to-ground or phase-to-ground/phase-to-phase high-voltage ratings as listed.
3. Arrester coordination may require higher BIL on multiple connections than indicated to achieve a minimum protection level of 20%.

2.3. The secondary voltage, configuration, and the basic insulation level (BIL) of the secondary voltage shall be ____________, {make a selection from Table 1}.

2.4. The transformer shall be furnished with full capacity high-voltage taps. The taps shall be +/- 2 - 2½% above and below nominal voltage. The tap changer switch shall be an externally operated switch with a hotstick-operable handle. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer as required in Section 3.3 of ANSI C57.12.26. Taps shall be provided on the higher voltage of dual voltage primary units.

2.5. The average winding temperature rise above ambient temperature, when tested at the transformer rating, shall not exceed 55°C and when tested at 112% of the base rating, shall not exceed 65°C.

2.6. The percent impedance voltage, as measured on the rated voltage connection, shall be per Table 2. For target impedances, the tolerance on the impedance shall be +/- 7.5% of nominal value for impedance values greater than 2.5%. The tolerance on the impedance shall be +/- 10.0% for impedance values less than or equal to 2.5%.
### PART 2 - Table 2 - Percent Impedance Voltage

<table>
<thead>
<tr>
<th>KVA Rating (Low voltage &lt; 700 V)</th>
<th>Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>1.10 - 5.75</td>
</tr>
<tr>
<td>112.5-300</td>
<td>1.40 - 5.75</td>
</tr>
<tr>
<td>500</td>
<td>1.70 - 5.75</td>
</tr>
<tr>
<td>750-3750</td>
<td>5.75 nominal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KVA Rating</th>
<th>Low voltage &gt; 700 V (all nominal values)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤150 kV BIL</td>
</tr>
<tr>
<td>1000 - 5000</td>
<td>5.75</td>
</tr>
<tr>
<td>7500 - 10000</td>
<td>6.50</td>
</tr>
</tbody>
</table>

3. HIGH VOLTAGE BUSHINGS AND TERMINALS

3.1. Bushing Style:
FOR 15/25 KV DEADFRONT, FOR CURRENTS BELOW 200 AMPS: The high voltage bushings shall be 15/25 kV 200A bushing wells with bushing well inserts installed. The bushings shall be externally removable and be supplied with a removable stud. (Examples: Cooper Power Systems catalog sections 800-32, 500-12, and 500-26)

FOR 35 KV DEADFRONT, FOR CURRENTS BELOW 200 AMPS: The high voltage bushing shall be a one-piece, 150 kV, 200-amp large interface load-break bushing. (Example: Cooper Power Systems catalog section 800-39)

FOR 15/25/35 KV DEADFRONT, FOR CURRENTS ABOVE 200 AMPS: The high voltage bushing shall be a 600A Deadbreak Primary One-Piece Bushing externally removable, 3Ø rated, integral design. 900 A can also be achieved using copper conductors. (Example: Cooper Power Systems catalog sections 800-45 and 800-47)

FOR UP TO 46 kV (250 KV BIL) DEADFRONT APPLICATIONS: The high voltage bushing shall be a CONNEX Plug-in Cable Termination System, size 3S. The male and female portions of the bushing shall be supplied with the transformer. This is only available in radial feed. (Example: see www.phoenixelectric-usa.com)

15/25/35 KV LIVEFRONT, 200 KV BIL MAX: The high voltage bushing shall be a porcelain bushing with a two, four, or six-hole spade or an eyebolt connector.

3.2. Bushing Configuration:
15/25 KV RADIAL FEED DEADFRONT: The transformer shall be provided with three (3) high voltage bushings in accordance with Figure 1 minimum dimensions (Figure 4a specific dimensions also available) of ANSI C57.12.34 for radial feed configurations. The bushing heights shall be in accordance with Figure 3 minimum dimensions (Figure 6 specific dimensions also available) of ANSI C57.12.34.

15/25 KV LOOP FEED DEADFRONT: The transformer shall be provided with six (6) high voltage bushings in accordance Figure 2 minimum dimensions (Figure 5a specific dimensions also available) of ANSI C57.12.34 for loop feed configurations. The bushing
heights shall be in accordance with Figure 3 minimum dimensions (Figure 6 specific dimensions also available) of ANSI C57.12.34.

35 KV RADIAL FEED DEADFRONT: The transformer shall be provided with three (3) high voltage bushings in accordance with Figure 4b specific dimensions of ANSI C57.12.34 for radial feed configurations. The bushing heights shall be in accordance with Figure 6 specific dimensions of ANSI C57.12.34.

35 KV LOOP FEED DEADFRONT: The transformer shall be provided with six (6) high voltage bushings in accordance with Figure 5c specific dimensions of ANSI C57.12.34 for loop feed configurations. The bushing heights shall be in accordance with Figure 6 specific dimensions of ANSI C57.12.34.

250 KV BIL DEADFRONT: The transformer shall be provided with 3 bushings mounted 45° down from the horizontal, 60” from the ground, and 12” apart from each other.

15/25/35 KV LIVEFRONT, 150 KV BIL MAX: The transformer shall be provided with three (3) bushings in accordance with Figure 9 of ANSI C57.12.34 for radial feed configurations. The bushing heights shall be in accordance with Figure 10 of ANSI C57.12.34.

200 KV BIL LIVEFRONT: The transformer shall be provided with 3 bushings with phase-to-phase and phase-to-ground clearances adequate for 200 kV BIL.

4. SECONDARY VOLTAGE BUSHINGS AND TERMINALS

4.1. Bushing Style:
For voltages less than 700 Volts: The transformer shall be provided with tin-plated spade-type bushings. The spacing of the connection holes shall be 1.75” on center, per ANSI C57.12.34 figure 13. The quantity of connection holes shall be 4, 6, 8, 10, 12, 16, 20 holes.

Standard/Possible Bushing Hole Quantities:

<table>
<thead>
<tr>
<th>KVA</th>
<th>208Y/120</th>
<th>480Y/277 and higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-300</td>
<td>4 standard, 16 possible</td>
<td>4 standard, 16 possible</td>
</tr>
<tr>
<td>500</td>
<td>6 standard, 12 possible</td>
<td>4 standard, 16 possible</td>
</tr>
<tr>
<td>750-1500</td>
<td>10 standard, 20 possible</td>
<td>6 standard, 12 possible</td>
</tr>
<tr>
<td>2000-3750</td>
<td>out of product scope</td>
<td>10 standard, 20 possible</td>
</tr>
</tbody>
</table>

(Example: Cooper Power Systems catalog sections 800-14, 800-16, and 800-21)

Bushing supports shall be provided for units requiring 10 or more connection holes. Bushing supports shall be attached to the cabinet sidewalls; tank-mounted support mountings are not acceptable.

4.2. Bushing Configuration:
The transformer shall be provided with bushings in a staggered arrangement in accordance with Figure 11a minimum dimensions (Figure 12a specific dimensions also available) of ANSI C57.12.34.
For voltages greater than 700 Volts: Refer to section 3.1 for the bushing type. Secondary arrangements are available in radial live front and loop or radial deadfront with a porcelain X0 bushing.

5. TRANSFORMER PROTECTION AND SWITCHING

5.1. Overcurrent Protection:
Bayonet with or without current limiting fuses: (available up to 130 amps of full-load transformer current, up to 34.5 kV grounded wye, or 17.1 kV delta). The high-voltage overcurrent protection scheme provided with the transformer shall be an externally removable loadbreak expulsion Bay-O-Net fuse assembly with a flapper valve to minimize oil spillage. The bayonet fuses shall be in series with ELSP under-oil partial-range current-limiting back-up fuses with an interrupting rating of 50,000 A. (Example: Cooper Power Systems catalog sections 240-40, 240-45, 240-46, 240-47, 240-48, 240-49, and 240-50) for voltages 23000GY and above and a delta connected secondary, bayonet fuses are not available.

Optional Accessory: An interlock shall be required between the load-break switch scheme specified and the bayonet fuses, such that the fuses may not be removed unless the transformer has been de-energized via the load-break switch scheme.

Magnex® Interrupter or equivalent: (available up to 42 amps of full-load transformer current, up to 35 kV), The high-voltage overcurrent protection scheme provided with the transformer shall be a three-phase trip Magnex® Interrupter. This externally resettable device may also be used as an on-off switch. The three-phase Magnex® Interrupter shall be in series with ELSP under-oil partial-range current-limiting back-up fuses with an interrupting rating of 50,000 A. (Example: Cooper Power Systems catalog sections 240-33 and 240-50)

Integral Vacuum Fault Interrupter (VFI): (available from 13 amps up to 712 amps of full-load transformer current, up to 34.5 kV, grounded wye or delta) The high-voltage or low-voltage overcurrent protection scheme provided with the transformer shall be an integral Vacuum Fault Interrupter (VFI). The VFI shall have a maximum interrupting rating of 12000A RMS symmetrical with resettable fault protection up through 35kV. The VFI shall also include a Tri-Phase electronic breaker control with over 100 minimum trip settings and 5 selectable time current curves. The minimum trip setting shall be XX amps, and curve profile shall be the EF, KF, TF, F, or H. (Example: see Cooper Power Systems bulletins 97055 and 02039 and catalog section S285-75-1 for the electronic control)

Optional VFI Accessories: SCADA board; Secondary ground fault protection; Motor operator assembly; visible break window.

5.2. Overvoltage Protection:
The overvoltage protection scheme provided with the transformer shall protect the high-voltage or low voltage winding.

With DEADFRONT bushings: (150 kV BIL, for voltages up to 22 kV delta and 35 kV grounded wye). Externally mounted, Distribution Class M.O.V.E. Deadfront elbow arresters shall be supplied. (Example: Cooper Power Systems Catalog section 235-55 and
If primary bushings are 600 amp or 900 amp, T-OP II elbow connectors are required with load-reducing tap plug for arrester connection.

UNDER OIL: (for voltages up to 35 kV). Internally mounted, Distribution Class MOV under-oil surge arresters shall be supplied. (Example: Cooper Power Systems Catalog Section 235-95)

Optional Accessory: Three (3) disconnect switches shall be included to disconnect the under-oil arresters from ground for transformer testing. (Example: Cooper Power Systems catalog section 800-51)


5.3. Switching:
The primary switching scheme provided with the transformer shall be one (only available option for radial feed), two, three on/off, one four-position V-blade, one four-position T-blade loadbreak switch. Refer to Appendix 1 for the schematics of these switching options. (Example: Cooper Power Systems catalog sections 800-64 and 800-65)

Make-before-break option for four-position, sectionalizing switch: This switch option provides improved system reliability by eliminating momentary interruptions during switching operations.

6. GENERAL DESIGN

6.1. Core and coil
The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper.

6.2. Dielectric fluid
The dielectric coolant shall be listed less-flammable fluid meeting the requirements of National Electrical Code® Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2-1997), Section 15. The dielectric coolant shall be readily and completely biodegradable per EPA OPPTS 835.3100. The base fluid shall be 100% derived from edible seed oils with performance enhancing additives. The fluid shall result in zero mortality when tested on trout fry per OECD G.L. 203 and be non-bioaccumulating. The fluid shall be published under US EPA Environmental Technology Verification (ETV) requirements, and tested for compatibility with transformer components. The fluid shall be Factory Mutual Approved, UL® Classified Dielectric Medium (UL-EOUV) and UL Classified Transformer Fluid (UL-EOVK), Envirotex® FR3® fluid. (Example: see www.cooperpower.com/fr3)
6.3. Tank and Cabinet Enclosure

6.3.1. The high-voltage and low-voltage compartments, separated by a metal barrier, shall be located side-by-side on one side of the transformer tank. When viewed from the front, the low-voltage compartment shall be on the right. Each compartment shall have a door that is constructed so as to provide access to the high-voltage compartment only after the door to the low-voltage compartment has been opened. There shall be one or more additional fastening devices that must be removed before the high-voltage door can be opened. Where the low-voltage compartment door is of a flat panel design, the compartment door shall have three-point latching with a handle provided for a locking device. Hinge pins and associated barrels shall be constructed of corrosion-resistant material, passivated AISI Type 304 or the equivalent.

6.3.2. A recessed, captive, penta-head bolt that meets the dimensions per ANSI C57.12.28 shall secure all access doors.

6.3.3. The enclosure integrity of the tank and cabinet shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including but not limited to the pry test, pull test, and wire probe test.

6.3.4. The compartment depth shall be in accordance with C57.12.34, unless additional depth is specified.

6.3.5. The tank base must be designed to allow skidding or rolling in any direction. Lifting provisions shall consist of four lifting lugs welded to the tank.

6.3.6. The tank shall be constructed to withstand 7 psi without permanent deformation, and 15 psi without rupture. The tank shall include a 15 psig pressure relief valve with a minimum flow rate of 35 SCFM.

6.3.7. The tank and cabinet coating shall meet all the requirements of ANSI C57.12.28 including:

- Salt Spray Test
- Crosshatch Adhesion Test
- Humidity Test
- Impact Test
- Oil Resistance Test
- Ultraviolet Accelerated Weathering Test
- Abrasion Resistance - Taber Abraser

6.3.8. The exterior of the unit shall be painted Munsell 7GY3.29/1.5 green in color. The cabinet interior and tank face shall be painted gray for ease of viewing the inside the compartment.

6.3.9. The tank shall be complete with an anodized aluminum laser engraved nameplate. This nameplate shall meet Nameplate B per ANSI C57.12.00.
7. ACCESSORIES

The following accessories shall be provided (non-standard options are in yellow):

- Bolted main tank cover (1000 kVA & below)
- Welded main tank cover with bolted handhole (1500 kVA & above)
- 1.0” upper fill plug
- 1.0” drain plug in LV compartment (500 kVA & below)
- 1.0” drain valve w/ sampling device in LV compartment (750 kVA & above)
- Automatic pressure relief valve
- Metal drip shield (when bayonets specified)
- 20” deep cabinet (2500 kVA & below)
- 24” deep cabinet (3000 kVA & above)
- Ground provisions per C57.12.34 section 9.11.
- Meet NEMA TR-1 sound levels
- Liquid level gauge
- Dial-type thermometer gauge
- Pressure vacuum gauge
- 1.0” drain valve w/ sampling device in (LV or HV) compartment (500 kVA & below)
- Upper fill valve
- Pressure vacuum bleeder
- 24” deep cabinet
- 30” deep cabinet
- 36” deep cabinet
- 40” deep cabinet
- Spare bayonet fusing
- Ground connectors
- Mr. Ouch warning & danger signs
- Danger high voltage warning signs
- Miscellaneous stenciling
- Touch-up paint
- Interphase barriers (for live front primary units only)
- Seismic zone 3 and 4 tank anchoring
- Complete 304 stainless steel tank and cabinet
- Rapid rise relay with seal-in panel
- Winding temperature indicator
- Watt-hour meter package – includes GE kV Vector Meter (digital demand register). Factory supplied wiring shall be internal to the cabinet, not in conduit. Communication connection shall be the OPTOCOM port. (Example: Cooper Power Systems reference section R210-70-1)
- Factory Mutual (FM) Approved transformer (for NEC Code-listed installations on, near, or inside of buildings)
- UL Listed and Classified transformer (for NEC Code-listed installations on, near, or inside of buildings) per UL XPLH
- UL Listed transformer (certifying compliance with ANSI standards only) per UL XPLH
• Increased efficiency criteria / evaluated losses:
• Core loss evaluation (A-factor) $/watt
• Winding loss evaluation (B-factor) $/watt
• NEMA TP-1 Efficiency design (2500 kVA and below)

8. SHIPPING

Units 1000 kVA and below shall be palletized. Units 1500 kVA and larger shall be loaded and unloaded with overhead cranes, so a pallet is not to be provided for these transformers.

9. TESTING & TOLERANCES

9.1. All units shall be tested for the following:
  • No-Load (85°C) losses at rated current
  • Total (85°C) losses at rated current
  • Percent Impedance (85°C) at rated current
  • Excitation current (100% voltage) test
  • Winding resistance measurement tests
  • Ratio tests using all tap settings
  • Polarity and phase relation tests
  • Induced potential tests
  • Full wave and reduced wave impulse test

9.2. In addition, the manufacturer shall provide certification upon request for all design and other tests listed in C57.12.00, including verification that the design has passed short circuit criteria per ANSI C57.12.00 and C57.12.90.

9.3. IF THE TRANSFORMER HAS EVALUATED LOSSES, The no-load losses of a transformer shall not exceed the specified no-load losses by more than 10%, and the total losses of the transformer shall not exceed the specified total losses by more than 6%.

10. DATA WITH PROPOSAL

The following data shall be submitted with the proposal:
  • Core losses
  • Winding losses
  • Percent Impedance
  • Typical record drawings
  • Approval drawings (furnished at time of order)
  • Final record drawings (furnished at time of shipment)

11. APPROVED MANUFACTURERS

Cooper Power Systems—Waukesha WI, or approved equal
APPENDIX 1: Switching Options and Schematics

1 On/Off Switch

2 On/Off Switches

3 On/Off Switches

4-position sectionalizing switches:
V-blade switch

T-blade switch

PART 3 - Feed from B only
Open — the loop is open and the transformer is de-energized

Description of positions:
Feed from A & B
Feed from A only

Description of positions:
Feed from A & B
Feed from A only
Feed from B only
Open — the loop is closed and the transformer is de-energized
PRODUCT SPECIFICATIONS

Optics
Round Precision reflector with 55° visual cutoff to both lamp and lamp image • Single position optic eliminates possibility of specified lamp being installed in incorrect position • Low IR/Infrared specifiers or with Alzak® 0.050” thick reflector in clear, gold, white, or black • Baffle: Plastic, clear Alzak® upper reflector and white or black painted, deep-milled, smooth aluminum baffle insert with integral flange painted white.

Electrical
Ballast: Class “P” thermally protected 120-277V universal voltage high power factor electronic ballast with end of life protection
Lamp Holder: 4-pin 5040Y U4, insulated thermoplastic socket with non-fusing stainless steel lamp retention spring.

Mechanical
Socket Housing: Heavy gauge deformed galvanized steel
Mounting Frame: 8-gauge galvanized steel mounting ring with factory installed spring steel friction clips • Accommodates ceilings up to 3/4” thick ceiling thickness adapter accessory is available for ceilings up to 2” • Common weight section accepts open, single wall wash and braced reflector.
Mounting Bracket: Mounting brackets have 3” vertical adjustment and accept proprietary T-bar (1/2” X 1”, 1/2” X 1 1/2”, 3/4” X 2” X 2 1/2”, 3/4” X 2” X 4”)

Ordering Information:

Example: C6H-226G-8R

Example: C6H-213Q, C6H-218Q, C6H-226Q

Example: C6H-133Q, C6H-118Q, C6H-126Q

Example: C650, C652, C650BR, C652BR

Example: LB-TL

Example: LB-TL

Example: HB-TL

Example: LB-TL
Product Specification

LED ENGINE
Light engine shall include an array of Cree X-Series high power LED's (light emitting diodes) mounted to a multi-sided, vertical heat sink of highly conductive aluminum (B2, B3 light engine) or mounted to a metal core circuit board (P4 light engine) both using GMT technology. The LED emitters are mounted to removable circuit boards such that they are in full thermal contact with the heat sink. The B2/B3 vertical heat sink is open at the bottom and vented at the top to provide appropriate dynamic airflow cooling for the LED array. The emitters are arranged in various patterns on each light engine to provide the required ENSA light distribution.

OPTICS
The LED arrays include optical lenses constructed of polished aluminum extrusion or thin clear optical grade acrylic with precision reflector over each diode (PN). Both optical options are designed to efficiently control light distribution.

LENSES
The lens panels shall be made of polycarbonate or acrylic. The polycarbonate shall be a minimum of 3/16" thick and composed of Bayer Makrolon LTG 3123, General Electric Lexan 243, or equivalent. The acrylic shall be a minimum of 3/16" thick and composed of Akrolux, VBC5-F, UVASLA, SQP75-UVLA, Cygo S-10-I-6-3, or equivalent. This is available in either clear or colored configurations.

LUMINAIRE CONSTRUCTION
All K56 cast components shall consist of a heavy grade A356 cast aluminum. The main body or capital, with or without an enclosure for the ballast and assembly, is of adequate thickness to give sufficient structural rigidity. The capital shall have an opening at the base tenon body to allow the luminaire to be mounted to a tenon of 3 1/2" maximum diameter. The Luminaire shall be locked in place by means of heavy duty, stainless steel set screws.

LUMINAIRE ASSEMBLY
The luminaire assembly is a self-contained unit consisting a rugged cast aluminum body, and the LED light engine consisting of aluminum castings and the LED light engine. The LED light engine is of a modular design, and is able to be quickly removed from the luminaire assembly without the need to disassemble the luminaire assembly itself. The luminaire assembly is composed of a polygonal cast top and bottom rings and eight cast aluminum struts comprising the housing. The threaded lid is cast aluminum and is secured to the main housing by a stainless steel rotary latch.

DRIVER
The LED universal dimmable driver will be class 2 and capable of 120 - 277V or 277 - 400V input voltage, greater than 0.9 power factor, less than 20% total harmonic distortion and fixture ambient temperature range of -35 °C to 90 °C. Each LED system comes with a standard surge protection designed to withstand up to 20kV/MIL/204B line surge as per IEC 62424-1 C 0.1. High. The driver assembly will be mounted on a heavy duty lubricated or galvanized steel mounting bracket to allow complete tool-less maintenance. Included will be a multi-wattage selector switch which will allow the output power of the driver to be field selectable.

PHOTOMETRICS
Fixtures are tested to IESNA LM79 specifications. These reports are made available.

CHROMATICITY
High output LEDs come standard at 4500K (12-250K) with a minimum nominal 70 CRI. Additional CCT emitters are available upon request.

LUMEN MAINTENANCE
Reported (L90) and Calculated (L70) reports are available upon request with a minimum calculated value of 100,000 hrs.

WIRING
All internal wiring and connections shall be completed so that it will be necessary only to attach the incoming supply connections to the

38 3/8"
KING MODEL K56 CLEVELAND LUMINAIRE
WITH 100 W LED LAMP K6/K9 CAPITAL

Fixture Options

Cleveland

Tudor
SECTION 16670
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 OBJECTIVE

A. To provide safety for the building and occupants by preventing damage to building structure caused by lightning.

1.2 STANDARDS

A. The following specifications and standards of the latest issue form a part of this specification:
   1. Lightning Protection Institute Installation Standard, LPI 175
   3. Underwriters Laboratories, Inc. Installation Requirements, UL96A

1.3 SYSTEM DESIGN

A. The work covered by this section of the specifications consists of furnishing all labor, materials, and items of service required for the completion of a functional and unobtrusive lightning protection system as approved by the architect, engineer, and in strict accordance with this section of the specifications and the applicable contract drawings.

B. If any departure from the contract drawings or submittal drawings covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the architect/engineer for approval.

1.4 SUBMITTALS

A. Complete design drawings showing the type, size, and locations of all grounding down conductors, through roof/through wall assemblies, roof conductors, and air terminals shall be submitted to the architect and engineer for approval.

1.5 QUALITY ASSURANCE

A. The lightning protection system shall conform to the requirements and standards for lightning protection systems of the LPI, UL, and NFPA. Upon completion, an application shall be made to the Underwriters Laboratories, Inc. for inspection and certification and shall be delivered to the owner ensuring that the concealed components have also been monitored during job progress.
PART 2 - PRODUCTS

2.1 STANDARD

A. The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled.

B. All equipment shall be new and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, and NFPA code requirements.

C. Qualified Manufacturers:
   1. Advanced Lightning Technology
   2. East Coast Lightning Equipment
   3. Erico

2.2 LIGHTNING PROTECTION EQUIPMENT

A. All materials shall be copper and bronze and of the size, weight, and construction to suit the application and used in accordance with LPI, UL, and NFPA code requirements. Class I sized components may be utilized on roof levels 75 feet and below in height. Class II sized components are required for roof levels over 75 feet in height. Bolt type connectors and splicers shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware shall be stainless steel to prevent corrosion.

2.3 ALUMINUM COMPONENTS

A. Aluminum materials may not be used except on roofs that utilize aluminum, galvalume or galvanized metal roofing components. On aluminum, galvalume or galvanized metal roofs or where aluminum, galvalume or galvanized metal parapet caps exist, the entire roof lightning protection equipment shall utilize aluminum components to insure compatibility. However, the down leads and grounding are to utilize copper with the bimetal transition occurring at the through roof assembly with an approved bimetal through roof assembly.

2.4 LIGHTNING ARRESTERS

A. A surge arrester at the main electrical service entrance is required by Underwriters Laboratories UL96A lightning protection codes and in order to obtain the UL Master Label Certificate of Inspection. It shall be the responsibility of the electrical contractor to install or verify that a surge arrester is installed on the main electrical service.
PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall be accomplished by an experienced installation company that is UL listed, a member of the Lightning Protection Institute and an employer of Certified Master Installers of lightning protection systems. For example: Bonded Lightning Protection Systems – Dallas/Ft. Worth 972-247-1988, Houston 713-688-1909, Austin 512-477-9855, San Antonio 210-657-0400, New Orleans 504-464-8800, Mobile 334-433-4466. A Certified Master Installer shall directly supervise the work. All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads, and proper ground terminals. Copper down lead conductors shall be utilized even when aluminum is required on the roof. Down lead conductors in conduit shall not be brought directly through the roof. Through roof assemblies with solid brass or stainless steel rods shall be utilized for this purpose. Structural steel may be utilized in the installation as outlined by UL, NFPA, and LPI.

3.2 COORDINATION

A. The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation. The roofing contractor will be responsible for sealing and flashing all lightning protection roof penetrations as per the roof manufacturer's recommendations. However, the lightning protection contractor will be required to coordinate locations of through roofs and submit details of through roof penetrations as required. The lightning protection contractor shall use a compatible adhesive to adhere lightning protection components to the roof when required. The lightning protection contractor shall furnish and install the adhesive and obtain an approval of the compatible adhesive from the roof manufacturer/contractor prior to the installation. Should the roofing contractor/manufacturer require any special walk pads, membrane patches, pavers, etc. under the components of the lightning protection system, it shall be the responsibility of the roofing contractor to furnish and install such items. The lightning protection installer shall be responsible for marking the roof with all conductor and/or pad locations.

B. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other ground systems.

3.3 COMPLETION

A. Upon completion of the installation, the lightning protection installer shall secure and deliver to the owner the Underwriters Laboratories, Inc. Certificate of Inspection.

NOTE: FOR PROJECT CLARIFICATION, USE ONE PARAGRAPH OF PART IV IF PROJECT CONNECTS TO AN EXISTING STRUCTURE.

PART IV - CLARIFICATIONS:

4.1 CLARIFICATION
This specification recognizes that UL will not certify structures or additions that are attached to a structure which does not fully comply with current UL96A lightning protection standards.
Therefore, all attached structures shall be reviewed for compliance. The attached structure(s) not fully complying because of damaged systems, missing systems or improperly installed systems shall be fully protected and/or repaired in order to obtain all required inspections and certifications for the owner.

4.2 CLARIFICATION
This specification recognizes that UL will not certify structures or additions that are attached to a structure which does not fully comply with current UL96A lightning protection standards. Therefore, lightning protection shall be provided for new buildings only. Upon completion of the installation, the installer shall furnish a written guarantee of UL compliance. In addition, a written report of work and cost needed on attached structure(s) in order for the facility to qualify for the UL Master Label Certificate of Inspection will be required. If no work is necessary, the UL Master Label Certificate of Inspection shall be provided.

NOTE: SPECIFYING PERSONNEL SHOULD USE ONLY ONE PARAGRAPH 4.01 IN ORDER TO CLARIFY PROJECT REQUIREMENTS AT BID TIME. IF PROJECT IS NOTATTACHED TO EXISTING STRUCTURE(S) DELETE PART IV.

NOTE: LIGHTNING PROTECTION PENETRATIONS AND/OR ATTACHMENT PROCEDURES SHOULD BE ADDRESSED IN THE ROOFING SECTION OF THE SPECIFICATIONS.

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END OF SECTION 16670
**Prime-A-Pell® H2O Series 633**

**Product/Purpose**
- **General Description:** Concrete, stone and masonry treated with diluted Prime-A-Pell H2O resist water intrusion, stain damage, freeze/thaw spalling, efflorescence and rust damage.
- **Product Distribution:** Prime-A-Pell H2O is a clear, finisher, penetrating water-based water repellent for virtually all above-ground, vertical concrete, masonry, precast, block, asphalt and black masonry. The sealer does not alter the color or texture of the surface, nor significantly affect the appearance qualities of the substrate. The sealer penetrates the substrate and chemically reacts to create a tough barrier against water penetration. This barrier is constant to allow the substrate to breathe and water damage.
- **Colors:** Prime-A-Pell H2O is milky-white when applied; dried invisible, leaving the aesthetic appearance of the substrate unchanged.
- **Performance Criteria/Limitations:** Contact your Chempro/Toennies representative for specific test results.
- **Prime-A-Pell H2O** is not recommended for use on horizontal or below-grade surfaces. It is not intended to seal visible cracks or as a substitute for repairing defective masonry joints. A water repellent may not be able to completely protect walls, only on all surfaces, two-coat applications, applied well-on, may be required for adequate performance. The substrate should not be acid washed after application. Prime-A-Pell H2O may have limited efficacy on cementsitious masonry such as brick, stone and block. The product is not appropriate for application to polished stone. Prime-A-Pell H2O must penetrate into and react with the substrate for effective repellency. Therefore, it is not suitable for painted or textured surfaces. If brick, stone or masonry replication and smooth stone is desired, one Chempro/Toennies treated from 90 degrees (122 degrees Celsius) in conjunction with Prime-A-Pell H2O.

**Surface Preparation**

**All Surfaces**
- The surface to be treated must be sound, dry and free of cracks, dirt, oil, efflorescence, paint, curing compounds and all other contaminants, which may affect the penetration of Prime-A-Pell H2O. Fill all cracks, voids and repaired masonry joints if necessary. New concrete and mortar must be allowed to cure at least 45 days before treatment. Surfaces and air temperature must be between 65°F (18°C) and 90°F (32°C). Prime-A-Pell H2O is applied to exterior concrete to own time, which is determined at temperatures below 65°F (18°C). Protect treated surfaces from rain and favor application for proper curing. A minimum of 3 days. Allow 7 to 14 days before evaluating performance. Propane torches, stove� and open flame equipment should not be used contact with surfaces not suitable for treatment, remove epoxy immediately with mild soap and water. Do not allow soap solution to contact the surface being treated.

**Technical Data**

**Volatile Organic Compounds (VOC):**
- EPA Method 24: 0.16 lbs/gal (19 grams/liter)
- SOLIDITY IN WATER: Soluble
- pH: 7-8
- **Active Ingredients:**
  - Oligomeric Alkylsilane/AlkylsilaneSiloxane
- **Active Content:** 7%
- **Appearance:** Milky white liquid
- **Packaging:**
  - 1 gallon (3.78 liters) can, 5 gallons (18.94 liters) pail, 55 gallons (208.2 liters) drums
- **Net Weight per Gallon:** 8.33 ± 0.10 lbs (3.78 kg)
- **Storage Temperature:** Minimum 59°F (15°C) - Maximum 100°F (38°C)
- **Shelf Life:** 12 months at recommended storage temperature.
- **Flash Point - Set:** >212°F (100°C)
- **Health & Safety:**
  - Faint and related products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheets for important health and safety information prior to use of this product. Keep out of the reach of children.

**© April 02, 2007 by Toennies Co., Inc.**
**Prime-A-Pell H2O Series 633**

**Application**

Coverage rates are guidelines and will vary depending upon the texture of the surface and porosity of the substrate.

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Sq. Ft./Gal.</th>
<th>oz./MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHU (normal)</td>
<td>50 - 75</td>
<td>1.2 - 1.8</td>
</tr>
<tr>
<td>CHU (renovel)</td>
<td>100 - 225</td>
<td>2.5 - 3.5</td>
</tr>
<tr>
<td>Brick</td>
<td>100 - 225</td>
<td>2.5 - 3.5</td>
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<tr>
<td>Precast</td>
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<td>4.5 - 7.5</td>
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<td>Concrete beams</td>
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<td>GPMC</td>
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<td>Cast Stone</td>
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<td>Slate</td>
<td>80 - 100</td>
<td>7.5 - 9.8</td>
</tr>
</tbody>
</table>

A test application must be performed to determine the exact coverage rate, desired performance and compatibility of Prime-A-Pell H2O and the substrate before beginning a job.

Do not glue to thin; Prime-A-Pell H2O must be used as supplied by the manufacturer.

Mix well before application. Apply using a low-pressure spray or gear pump sprayer with a fan tip (0.05-0.06 orifice) that allows for application of the product at 20-30 psi. A commercial grade pump-up sprayer equipped with a fan tip is also acceptable. Airless point sprayers are not acceptable for the application of water repellents. Do not tint the product.

On vertical installations, apply with a wet-on-wet technique. Apply a saturating application of the product working from the bottom up. On porous substrates such as concrete masonry units, allow a slight rundown (less than three inches) of high density materials such as precast concrete panels or GPMC, do not allow any rundown. On all substrates allow the product to penetrate the substrate for approximately 5 to 7 minutes, then apply again in the same manner. This second pass will remove excess material. Follow coverage rate geometries, however, a test application should always be performed.

On horizontal installations, apply in a single, saturation application. Apply enough material for the surface to retain water for 1 to 3 minutes before absorbing into the substrate. Do not allow puddles to remain on surface; any areas of pooling should be trimmed out.

**Maintenance**

More required than ever when Prime-A-Pell H2O is no longer permits water or water-related protection. Life expectancy is dependent upon surface conditions and quality of application.

**Cleaning**

Clean equipment after use with water and mild detergent.
SECTION 16725

TELEPHONES

PART 1 - GENERAL

1.1 SUMMARY

A. This standard is intended for all “standard” installations at the Dallas campus and is not intended to address special installations that are sometimes encountered and addressed on an individual basis. All new construction and major renovation require a custom bid specification to be provided by OIT based on information provided by PD&C.

B. This section includes manufacture specifications and the roles and responsibilities for procurement and placement of free standing emergency phone pedestals and wall mounted units.

C. Products installed under this section:
   1. Concrete Pad with Anchor Bolts (installed by general contractor – Section 2.2)
   2. Grounding Rod (installed by electrical contractor – Section 2.2)
   3. Dedicated 110 Electrical Power (installed by electrical contractor – Section 2.4)
   4. (2) 1” Conduit Pathways to nearest networked SMU networked structure (installed by general contractor – Section 2.2 & 2.3)
   5. Free Standing Emergency Phone Pedestal or Wall Mounted Unit (installed by general contractor – section 2.4)

1.2 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.
   1. General:
      a. National Electrical Code (NEC)
      b. National Electrical Safety Code (NESC)
      c. Occupational Safety and Health Act (OSHA)
   2. Communications:
      a. ANSI/TIA/EIA - 568-B: Commercial Building Telecommunications Cabling Standard
      b. ANSI/TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
      c. ANSI/TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
      d. ANSI/TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
      e. ANSI/TIA/EIA - TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
      f. NECA/BICSI 568-2001: Standard for Installing Commercial Building Telecommunications Systems
g. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard
h. ISO/IEC IS 11801: Generic Cabling for Customer Premises
i. BICSI: BICSI Telecommunications Cabling Installation Manual
j. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)

1.3 DEFINITIONS

A. “BDF” shall mean Building Distribution Frame. This is the room that houses the telecomm equipment for a building and connects to Patterson Hall switch room (MDF).

B. “IDF” shall mean Intermediate Distribution Frame. Connects floors in a building to the building BDF.

C. “MDF” shall mean Main Distribution Frame.

D. “UTP” shall mean Unshielded Twisted Pair cable.

E. “Link” is defined as station cabling, work station outlet and patch panels/termination blocks.

F. “OSP” shall mean Outside Plant rated cabling.

1.4 QUALITY ASSURANCE

A. General Contractor will be selected by PD&C.

B. Communications Contractor Qualifications:
   1. SMU OIT will select the communications vendor based on availability and cost of the pre-qualified vendors:
      a. Able Communications
      b. (TBA)
   2. Contractor shall be trained and certified by the Manufacturers to install, test, and maintain the SCS and be certified by the SCS Manufacturers to provide the SCS Manufacturers’ Warranties (see PART 1 - WARRANTY).
      a. Systimax Solutions/ComScope (for copper).
      b. Systimax Solutions/ComScope (for fiber).
   3. Contractor’s employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS’ manufacturers. Training and certifications by employee type are required as shown below:
      a. Supervisors/Project Foremen: All (100%) shall be BICSI certified and Systimax Solutions/ComScope installations/testing certified.
      b. Test Technicians: All (100%) shall be trained/certified for installation and testing by Systimax Solutions/ComScope.
   4. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer trained and certified.
5. Contractor’s employees whose duties include the application of fire stopping material shall be trained and certified by the specified fire stopping manufacturer. Training and certifications by employee type are required as shown below:
   a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.
   b. Fire stopping Technician: All (100%) shall be trained/certified for installation of the fire stopping material.

6. Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). Contractor shall continue to employ a minimum of one RCDD throughout the duration of the project.

PART 2 - PRODUCTS

2.1 GENERAL

A. Placement of emergency phones shall be positioned accordingly:
   1. Wall mounted units need to adhere to the 90 meter rule. The phone with the conduit path is not to exceed 90 meters from the termination in the phone to the nearest BDF or IDF.
   2. Free standing pedestal units do not have the 90 meter rule. All phones exceeding 90 meters will require (1) 6-strand single mode fiber optic cable unterminated.

B. SCS components shall be manufactured by the manufacturers listed below. Components shall not be intermixed between different manufacturers unless the manufacturer of the SCS has listed (in writing) another manufacturer’s component as an “Approved Alternative Product” and will warrant the “Approved Alternative Product” as part of the SCS Manufacturer Warranty.
   1. Only the following SCS Manufacturers and only the manufacturers for which the Contractor is certified. The SCS Manufacturers shall be the following. Substitution is not acceptable:
      a. Systimax Solutions/ComScope, for copper-related products
      b. Systimax Solutions/ComScope, for fiber optic-related products

C. All copper-related components shall be part of the copper SCS product line and all fiber optic-related components shall be part of the fiber optic SCS product line – components shall not be intermixed between manufacturers’ SCS product lines. The SCS product lines shall be engineered “end-to-end” – the system and all of its components shall be engineered to function together as a single, continuous transmission path.
   1. The SCS Product Line shall be the following, per manufacturer. Substitution is not acceptable:
      a. For Copper Distribution: Systimax Solutions/ComScope
      b. For Fiber Optic Distribution: Systimax Solutions/ComScope

D. All emergency phone related components shall be the SMU Police Department/OIT pre selected models of the Ramtel product line. Components shall not be intermixed between manufacturers.
1. For free standing pedestals: Ramtel PLC-10/ACA (11 inch square with 4 inch radius corners. Powder Coated in Architect Brown, White EMERGENCY on four sides.

2. 2) For wall mounted units: Ramtel PLW-6/ACA with Full Lens. Includes built-in LED High-Powered Combination Constant ON and Strobe with light over Phone Panel with 3 Speakers & Control Boards. Powder Coated in Neutral Gray. Blue EMERGENCY on two sides.

3. Each model must be installed with RR733/ACA (One Button Phone Model) with 2 inch palm button and ACA upgrade Custom Silk Screened Phone Panel (see attached SMU Screened Panel).

4. Each model must be installed with an auxiliary relay option.

E. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Contract Documents that is required for a fully operational, tested, certified and warranted system.

2.2 FREE STANDING PEDESTAL FOUNDATION

A. Pour the Foundation - A 20 inch square concrete column base shall be surrounded by undisturbed soil or back fill compacted to 95% density of surrounding undisturbed soil, and to the correct depth for the frost line in the Dallas area, with a minimum depth of at least 42 inches.

B. Conduit – Electrical and telephone line conduit, with a maximum combined diameter of 3 inches, should be run up through the center of the foundation hole. Provide about 18 inches of exposed flexible PCV coated conduit from the conduit in base to the connection box in column. To ensure proper grounding, a ½ inch x 8 foot copper rod must be inserted in the center of the foundation and tied to the steel bollard. (NOTE: Follow all national and local codes governing this installation).

C. Set the Anchor Bolts in the Wet Foundation – Four 24 inch L-shaped anchor bolts should be set into the foundation so that 2 ½ inches are left showing above the finished grade level. The anchor bolts should be aligned, 7 inches apart in a square formation around the exposed conduits.

2.3 CONDUITS, PATHWAYS AND CABLE SUPPORTS

A. All conduits placed for SMU will be clean and free of moisture prior to acceptance by the SMU Infrastructure Design Engineer. A letter of certification is to be provided by the conduit installation contractor verifying the testing and condition of the conduits.

1. Depth: Conduits are required to be a minimum of 24 inches below grade, standard depth is 30 inches.

2. Separations: Electrical and Communication conduits must be separated by a minimum of 12 inches along the entire path.

3. Conduit Composition: Schedule 40 PVC

4. Pull Boxes: A pull box is required every 100 feet or after 180 degrees of bends have been met.

5. Free Standing Pedestal: A minimum of (1) 1 inch and (1) 2 inch conduits are required for this installation.

a. (1) 1 inch conduit for the placement of 110 dedicated power from the phone pedestal to the nearest electrical panel.
b. (1) 2 inch conduit for the placement of (2) category 6 OSP rated UTP cables from the pedestal to the closest accessible ceiling in the closest networked SMU structure.
   a) (1) Belden 9462 rated 22 AWG STP cable from the pedestal to the closest accessible ceiling in the closest networked SMU structure.
   b) (1) 6 strand single-mode fiber cable from the pedestal to the closest accessible ceiling in the closest networked SMU structure unterminated.

6. Wall Mounted Unit: A minimum of (1) ¾ inch and (1) 1 inch conduits are required for this installation.
   a. (1) ¾ inch conduit for the placement of 110 dedicated power from the wall mounted unit to the closest electrical panel.
   b. (1) 1 inch conduit for the placement of
      a) (2) category 3 6 plenum UTP from the mounting plate to the closest accessible ceiling.
      b) (1) Belden 9462, 22 AWG STP cable from the pedestal to the closest accessible ceiling in the closest networked SMU structure.

B. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

2.4 EMERGENCY PHONE INSTALLATION AND CONNECTIVITY

A. Install units per manufactures provided specifications. Contact the SMU Infrastructure Design Engineer for installation schematics.

B. Electrical conductors must be placed by the general contractor and capped for a later termination.

C. Dedicated 20 amp connection of 110v AC dedicated power with (1) quad receptacle box and electrical disconnect.

2.5 CABLE

A. General: All terminations shall follow the 568B wiring standard. Station runs shall not exceed 90 meters. Splices of any kind will not be accepted. Cables shall be manufactured by the selected SCS Manufacturer.

B. Copper Cable:
   1. For OSP Voice and Data Distribution: Category 6 OSP, 4-pair, UTP, 24-AWG, solid copper conductors, encapsulated, black and shall meet or exceed the category 6 wiring standard requirements as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801:
      a. Shall be Systimax Solutions/CommScope
   2. For auxiliary relay cable requirements: Belden 9462, 22 AWG stranded (7x30) tinned copper conductors, PVC insulation, twisted pair, overall Beldfoil® shield (100% coverage), 22 AWG stranded TC drain wire, PVC jacket.

C. Fiber Optic Cable
1. For fiber optic cable: 6 strand OSP single mode fiber optic cable and shall meet or exceed standard requirements in ANSI/TIA/EIA 568-B.1, 568-B.1-1, 568-B.2, 568-B.2-1, 568-B.2-2, 568-B.2-3 and 568-B.3-1 – Commercial Building Telecommunications Cabling Standard and Optical Fiber Cabling Components Standards.
   a. Indoor portion of fiber will be installed in plenum rated inner duct from BDF/IDF to exterior penetration. Inner duct part number CF4X1c.
   b. Shall be Sytimax Solutions/Commscope.

2.6 LABELING AND ADMINISTRATION

A. Labels:
   1. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 - REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Remove surplus material and debris from the job site and dispose of legally.

3.2 DEMOLITION

A. Demolish existing telecommunications equipment, cable, materials, and incidentals no longer in use after installation of and cutover to the new SCS.
   1. Remove all materials demolished by the Contractor from the site and dispose of properly and legally.
3.3 **FIRESTOPPING**

A. Only employees trained/certified by the fire stopping manufacturer shall apply firestopping materials.

B. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.
   1. Provide fire stopping material for through and membrane penetrations of fire-rated barriers.
   2. Install fire stops in strict accordance with manufacturer’s detailed installation procedures.
   3. Install fire stops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.
   4. For demolition work, apply fire stopping to open penetrations in fire rated barriers where cable is removed. Apply fire stopping regardless of whether or not the penetrations are used for new cable or left empty after construction is complete.
   5. Fire stopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

3.4 **GROUNDING AND BONDING**

A. Grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.
   1. Grounding Rod: Provide one (shall be installed by the electrical contractor.)
   2. Grounding conductor shall be installed to bond all non-current carrying metal telecommunications equipment and materials to the nearest grounding rod.
      a. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.
   3. Lightning Protection: A minimum of (2) 12 pair gas tube lighting protector devices must be installed. One is to be located in the emergency phone and the other within 50 feet from the point of entry into the building structure.

3.5 **CABLING**

A. General (applicable to all cable types): Provide plenum (CMP, OFNP) rated cable for all wall mounted emergency phone units. Cabling shall bear plenum markings. Provide OSP (Outside Plant) rated cable for all free standing pedestal units.
   1. Install cable in compliance with ANSI/TIA/EIA and ISO/IEC 11801 requirements and BICSI TCIM practices.
   2. Install cable in a continuous (non-spliced) manner unless otherwise indicated by the SMU Infrastructure Design Engineer.
   3. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.
   4. Tie or clamp cabling. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with
the exception of ceiling support anchors) is not acceptable. Install tie-wraps in conformance with the SCS manufacturer’s installation recommendations. Do not over-tighten tie wraps or cause cross-sectional deformation of cabling. Install Velcro in the telecomm rooms, tie wraps will not be accepted.

5. Cable in the telecommunications rooms:
   a. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals with Velcro straps.

6. Cable terminating on patch panels located on racks:
   a. Route cables in telecommunications rooms to patch panels on racks by routing across ladder rack across top of rack and then down vertical wire managers to patch panel.

B. Copper Cable: Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.

1. For horizontal distribution: Provide OSP cable to the locations shown on the Contract Documents. Provide service loops with a minimum length of 12 inches in the emergency phone housing less than 10 feet in the BDF/IDF’s.
   a. Route OSP cable that is exposed (not in conduit) to comply with ANSI/TIA/EIA-569 requirements for avoiding potential EMI sources and as follows:
      1) 48 inches from motors or transformers
      2) 12 inches from conduit and cables used for electrical power distribution
      3) 6 inches from fluorescent lighting

3.6 LABELING AND ADMINISTRATION

A. Affix a permanent label to the OSP cable at the terminations on each end with an assignment given by the SMU Infrastructure Design Engineer.

B. Grounding/Bonding Conductors: Label bonding conductors; “WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!”

3.7 ROLES AND RESPONSIBILITIES FOR EMERGENCY PHONE DEVICES

A. Office of Information Technologies: Gather user requirements from SMU Police Department (e.g. mass notification, surveillance and/or microphone; Review and select unit.

B. SMU Police Department: Identify strategic locations for placement of emergency phones.

C. Office of Information Technologies: Project lead for procurement and installation of the emergency phones.

D. SMU Police Department: Shall perform monthly testing of the emergency phones and report all non-functioning phones to OIT for repair.

E. Facilities: Responsible for coordinating and funding maintenance/repair activities.
F. Funding:
1. Facilities Project Funded Initiatives: Incorporate procurement and installation cost of the new phones into new buildings and major renovation budgets, including parking structures and open area malls/plazas.
2. Emergency Management: For new installations in existing areas outside of new construction or major renovations.

END OF SECTION 16725
STAINLESS STEEL COLUMNS

There is NO comparison to STAINLESS

Powder Coated in Stock Colors. Also available in custom colors and Natural Stainless Glass Bead Finish.

OPTIONS:
- Cellular, Solar, Cantilever Bracket
- Clear LEXAN door; Built-in Heater

ELECTRICAL:
- Columns and Wall Unit are pre-wired in conduit for 120 Volts AC power.
- Electrical Options:
  - Voltage 24 VAC to 440 VAC Breaker & Electrical Outlet

Phones purchased separately.
EMERGENCY PHONE

RED 1925
BLUE 286

RED LIGHT
PHONE ACTIVATED

GREEN LIGHT
CALL ANSWERED

EMERGENCY
PRESS BUTTON FOR ASSISTANCE
PHONE WILL AUTOMATICALLY DISCONNECT
PLC 10-11 3/4" SQ 4" RADIUS
STAINLESS STEEL COLUMN
COLUMN HEIGHT 92"
WITH LIGHT 98 3/8"

BOLT LAYOUT FOR COLUMN
(4) 9/16" BOLTS X 16" LONG

POWER CONSUMPTION
50 WATTS - 120 VAC
150 WATTS WITH HEATER

CONDUIT IN BASE OF COLUMN

PROVIDE ABOUT 18" LENGTH OF
PVC COATED FLEXIBLE CONDUIT
FROM CONDUIT IN BASE TO
CONNECTION BOX IN COLUMN
COLUMN IS PREFIRED

20" SQ CONCRETE COLUMN BASE
SHALL BE SURROUNDED BY
UNDISTURBED SOIL OR BACK
FILL COMPACTED TO 95% DENSITY OF SURROUNDING
UNDISTURBED SOIL

ANCHOR BOLTS
PLW-6 INSTALLATION INSTRUCTIONS

For Concrete, Cinder Block, Brick Mounting: Use Lag Bolt Expansion Shield - Bolt Size 5/16" x 1-1/2" Long
For Wood Mounting: Lag Screws 5/16" x 3-1/2" Long (supplied)

1) Remove phone from unit by unscrewing the six (6) tamper resistant front panel screws (tool provided). Then unplug phone line connector and emergency button external output connector.

2) Remove 3/8-16 x 1" Hex bolt from back section; lift off front cover.

3) Back half (A) must be mounted 39 1/16" inches above ground (42 9/16 to mounting hole) for ADA phone compliance. (see diagram).

4) Back half is attached to mounting surface using (4) 5/16 x 1 1/2" lag bolts and (4) 5/16" flat washers supplied.

5) Front cover (B) is attached by placing top of cover 1/4" over top of back half and sliding down. Re-install (1) 3/8-16 x 1" Hex bolt, to lock front to back.

6) Re-install phone.
MASS NOTIFICATION SYSTEM (MNS)

PART 1 - GENERAL

1.1 CONDITIONS

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section references provision and/or coordination of related material and services necessary to furnish a complete and operational MNS system as indicated on the drawings, or specified herein.

C. This design standard describes a multi-layered strategy to occupant notification and is comprised of two levels; the individual building level functions, and the integrated MNS control element. The individual building MNS functions consist minimally of a facility’s Fire Alarm and Voice Emergency Communication System and may also include an integrated distributed recipient notification system including; Digital Display/Video Signage systems, associated Emergency Telephones, etc. along with other methods identified to best communicate "real-time" emergency notification information permitting message delivery to the greatest number of target recipients within that building.

D. In application of this strategy, the sequence of notification (from all systems) must be considered, and any potential delays in the transmission of communications must be minimized. For these reasons, all systems identified must be integrated and coordinated with SMU’s designated centrally managed MNS.

E. Otherwise disparate systems & subsystems, currently considered as basic MNS building blocks, must be coordinated, verified as supported, and in most instances shall require both a hardware interface and a software license in order to be integrated into the overall MNS solution.

F. Although a fire alarm voice evacuation system is specified under another SMU Design Standard found elsewhere (where required), certain performance criteria for such systems are required within this Standard for message intelligibility and effective communication of audible messages to target recipients, and is therefore assumed.

G. In addition to new construction, this design is likewise applicable to contractors responding to requests-for-proposals for major system renovation who shall be directed to include all costs for required hardware and software elements, as necessary, for MNS integration when proposing an existing facility’s fire alarm system retrofit.

H. Contract Documents are based on Siemens Sygnal products and systems specified to establish a standard of quality. Other manufacturers offering products with equivalent performance characteristics may be considered, provided deviations are minor and said products are certified as supported, comply with all requirements of integration, interconnectivity, and offer cross-support for all existing and currently integrated systems and subsystems, and are deemed in compliance with all Contract Documents. All work shall be
in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1. The ongoing security system integration agreement between the Owner and Siemens, a Class B Contractor, stipulates that portions of this scope of work be performed and/or verified compliant by Siemens in order to preserve the operational integrity of disparate subsystems, assure adherence to Owners implementation philosophy, and preserve system warranty. Responding contractor elect shall coordinate with Owner’s representative prior to bidding. Siemens contact: James Holden 972-621-5727 Email: james.holden@siemens.com

1.2 WORK INCLUDED

A. This section includes coordination with the following:
   1. Information Technology & Communication
   2. Electronic Safety and Security
   3. Fire Alarm
   4. General Voice & Data Design Requirements
   5. Emergency Phone Requirements

1.3 APPLICABILITY

A. This section applies to new construction, major renovations, and affiliated subsystem upgrades of existing systems.

1.4 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.

1.5 PRE-INSTALLATION MEETING

A. Schedule a pre-installation meeting to review and discuss compatibility and integration of the proposed installation.

B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Siemens Building Technologies, Manufacturers representatives and a representative from SMU OIT and Police Department, and any other effected subcontractors or suppliers.

PART 2 - PRODUCTS

2.1 INTEGRATED MNS CONTROL

A. The integrated mass notification system shall be utilized for coordinating an intelligent response for the SMU campus. Siemens Sygnal will serve as an application based integration point for all notification systems and their end devices.
B. The MNS shall be the single point of administration for creation, administration, and initiation of security and life-safety notifications providing real-time information and instruction to people in a building, area, site, or campus-wide using voice communications along with visible signals, text, graphics, and possibly tactile or other communication methods instructing people of the necessary and appropriate response and action. Additionally, the integrated MNS shall be configurable to interface with Social Media, and provide RSS signaling via the SMU Campus Web Site.

2.2 INTERFACES WITH OTHER SYSTEMS

A. General. The communications systems shall be capable of interfacing with communications systems, both existing and future, on the SMU campus. The communications systems shall be designed with an established protocol that is provided to the SMU installation to allow existing and future individual building MNS elements from other manufacturers to interface with the integrated MNS. The integrated MNS contractor shall provide a standard interface method (such as an audio line-level output and multiple relay contacts) or supply the necessary digital communication protocols to permit the SMU installation to select more than one manufacturer of individual building MNS or sub-systems.

1. Primary system interfaces supported shall include:
   b. Digital Display Systems.
   c. Emergency Telephone Stations.

2. Additional system interfaces supported shall include:
   a. SMU Police Communications.
   b. PBX or IP Telephone Systems.
   c. Way-Finding.
   d. E-mail.
   e. Outdoor Warning Speakers.
   f. PC Alerts.
   g. Cell Phones.

B. Fire Alarm. An MNS interface to the fire alarm will be required at the respective building fire alarm control panel and consist optimally of a serial interface between the co-located fire alarm CPU and MNS interface network module. Alternatively, fire alarm contractor will be required to provide a monitor input to supervise the MNS trigger output, and provide an auxiliary audio level input for accepting the MNS audio signal.

C. Digital Display System. An RSS feed to the respective Nexus On-Demand system controller will be required at the systems central point of control.

D. Emergency Telephone Stations. Interface to the emergency telephones will require the All Campus Alert (ACA) option at all Ramtel telephone stations. An MNS Network connection to the ACA server will be required.
PART 3 - EXECUTION

3.1 REQUIREMENTS FOR SYSTEM DESIGNERS

A. Designer Qualifications. The MNS shall be designed under the supervision of a registered professional engineer with a minimum of four years’ current work experience in fire protection, electrical, and communication-electronics engineering areas specific to MNS. Alternately, the MNS may be designed by an engineering technologist verified by the National Institute for Certification in Engineering Technologies (NICET) as certified at Level IV in low voltage electronic-communications systems or Level IV in fire alarm systems, plus this engineering technologist shall possess a minimum of four years’ current work experience specific to MNS communications-electronics. Alternately, the MNS may be designed by an engineering technologist that possesses a minimum of ten years’ documented current work experience specific to MNS communications-electronics. The individual’s name, signature, and professional engineer number or NICET certification number (when applicable) shall be included on all final design documents.

3.2 SYSTEM INTEGRATORS AND CONTRACTORS

A. System integrators and contractors shall have demonstrated a full knowledge and understanding of systems used for mass notification, and that have factory-trained personnel to perform system design, installation, testing, training, and maintenance.

B. The MNS designer should have demonstrated expertise in audio system design, sound pressure and intelligibility measurement and evaluation, radio communications systems,

C. Contractors proposing systems identified above as supported by the MNS (Fire Alarm, Video Display, Digital Display, etc.) shall include the cost for providing required MNS interface hardware, software licenses, and programming, as required to fully integrate their work into the SMU MNS.
CLOSED CIRCUIT TV (CCTV)

PART 1 - GENERAL

1.1 SUMMARY

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section references provision and/or coordination of related material and services

C. The ongoing security system integration agreement between the Owner and Siemens, a Class B Contractor, stipulates that portions of this scope of work be performed and/or verified compliant by Siemens in order to preserve the operational integrity of disparate subsystems, assure adherence to Owners implementation philosophy, and preserve system warranty. Responding contractor elect shall coordinate with Owner’s representative prior to bidding. Siemens contact: James Holden 972-621-5727 Email: james.holden@siemens.com

PART 2 - PRODUCTS

2.1 GENERAL

A. All cameras shall feature a native IP-based PoE connection, offer multicast dual-streaming, with H.264/MPEG-4/JPEG compression. Analog cameras are not acceptable.

B. All cameras shall be certified as supported by SMU’s existing VMS vendor. http://www.genetec.com

C. All cameras shall feature a minimum resolution of 1.3MP. Cameras of lower resolution may be acceptable only in special applications and as specifically approved by SMU OIT.

D. All cameras shall be rated as vandal resistant.

E. Integral camera mini-domes shall feature a 3-axis gimbal allowing for full adjustment when wall mounted vertically.

MANUFACTURERS

F. Manufacturers and models listed are representative of the feature set and quality required. Alternative but equal cameras may be acceptable. All cameras as proposed shall be certified as supported as being fully supported by SMU’s video management system software.
2.2 INDOOR CAMERAS

A. All interior cameras planned for low-light area deployment shall feature true Day/Night (DN) capability, or integral LED-based IR illumination meeting minimum illumination on target relative to camera distance from target. Acceptable manufacturers and models:
   1. Axis P3384-V
   2. Sony SNC-DH160
   3. Arecont AV1255AM

B. All indoor cameras with an outdoor light source within the field of view (backlight) such as an interior camera at a building pedestrian entry/exit door, a parking garage vehicle entry lane, etc., shall include backlight compensation / wide dynamic range (WDR). Acceptable manufacturers and models:
   1. Sony SNC-VM600B
   2. Axis P3384-V
   3. Arecont AV1255AM

C. All fixed position indoor cameras shall be provided with variable focal length lenses appropriate for the camera distance to target, (f3.1-8.9mm, f4.5-10mm, etc.).

D. All indoor pan-tilt-zoom cameras shall feature a minimum 10x optical magnification.

2.3 OUTDOOR CAMERAS

A. All outdoor PTZ cameras shall be powered from a non-network originated (non-PoE) power source (i.e. 9-48V DC/AC) and shall be provided with additional conductors of the appropriate AWG calculated to support the specified external power relative to circuit length.

B. All outdoor pan-tilt-zoom cameras shall feature a minimum 20x optical magnification

C. All outdoor cameras & camera/housing combinations shall be minimally rated IP66.

D. All outdoor cameras & camera/housing combinations shall feature true Day/Night (DN) capability.

E. All outdoor PTZ camera outer domes shall be f-stop neutral with no light loss, but shall generally conceal the internal camera’s orientation from being detected from the ground.

F. Acceptable manufacturers and models:
   1. Sony SNC-ER585
   2. Axis P5532-E

END OF SECTION
AUDIO VIDEO TECHNOLOGY GUIDELINES

PART 1 - GENERAL

1.1 SUMMARY

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section references provision and/or coordination of related material and services

C. SMU has the following for minimum standards for Classroom, Conference rooms and other room types listed.

INTRODUCTION

The purpose of this document is to ensure that all Audio/Video (“AV”) installations are designed and installed with the highest standards as set forth by the Office of Information Technology (“OIT”) in conjunction with the Office of Facilities Planning and Management (Facilities).

All AV contractors, designers and consultants must adhere to these standards whenever possible. If for some reason these standards cannot be met, it is the responsibility of the contractor/designer/installer to consult directly with OIT and Facilities for approval of non-conforming equipment and or design.

There are four phases to any AV project: discovery, design, specification and installation. It is crucial that OIT and Facilities review and approve each phase of an AV project to insure that the system meets design criteria and can be supported by OIT.

Contractor Requirements and Certifications:

AV contractors must:

1. Be a local AV company or have a service center within 50 miles of Dallas, TX.
2. Provide documentation from other installations done at Higher Education Institutions.
3. Provide (3) three references from previous customers and timelines of completion of work.
4. Have proven AV project managers on staff and provide summary of work for each.
5. Have on staff a certified AMX ACE Expert or equivalent certifications for Installation/Design/Programmer/Audio Experts and produce documentation of certifications on demand. This staff person must have at least 3 years AMX experience and been employed by AV installer for at least 1 year.
6. Integrate all AMX programming into the campus’s AMX/RMS server.
7. Turn over all AMX programming to OIT and it will become the property of SMU. All passwords, access codes, and user names will be provided in writing.
8. Produce accurate as-builts of complete system (including proper labeling of cables).

9. All Audio Visual components must be commercial grade hardware, unless otherwise approved by the SMU AV team. All equipment needs to be easily accessible by technicians, either located in a lectern, or in a cabinet, or in an A/V closet. Equipment located in the ceiling, other than the projector, is not acceptable, unless it is located on the projector lift or the projector itself. All equipment that has front panel interfaces, that is not required to be accessed by the presenter, will require the front panel to be covered by a vented security panel or the equipment is located in a locked space. All new AV equipment must have the capability of being remotely managed. SMU has an unlimited number of licenses for AMX’s Resource Management System, RMS. Any podiums or lecterns need to have space to store the A/V equipment used for that room, and where a monitor is required will have to use a monitor arm.

**Room Definitions**

*Meeting*
*Conference*
*Seminar*
*Small Classroom*
*Large Classroom (ADA 219)*
*Lecture Hall*
*Computer Lab*
*Screening Room*
*Multi-purpose Room*

The classrooms are divided into different categories depending upon the number of students that the room can accommodate and the specific use of the room. The rooms are broken down into 8 different sizes and use. The different types are: Seminar, Classroom seating up to 25, Classroom seating 26 to 60, Classroom seating 61 to 100, Classroom seating over 100, Multipurpose room, Study or Meeting room, and Conference room.

A. Seminar rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape of the room. The Seminar room will include a control system, audio amplification, and a wireless lapel mic if lecture capture is required. This room will have the standard inputs/outputs included, either on the wall, or at the lectern. Tables should be movable to facilitate different teaching stiles.

B. Classrooms seating up to 25 will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape of the room. The rooms will include a control system, audio amplification, and a wireless lapel mic input if lecture capture is required. It will have the standard inputs/outputs included, either on the wall, or at the lectern.

C. Classrooms seating between 26 and 60 will have a projector and screen. The rooms will include a control system, audio amplification with speakers to provide coverage to the room,
and a wireless lapel mic input. It will have the standard inputs/outputs included at the lectern.

D. Classrooms seating between 61 and 100 will have a projector and screen. The rooms will include a control system, audio amplification with speakers to provide coverage to the room, and a wireless lapel mic input. It will have the standard inputs/outputs included at the lectern.

E. Classrooms seating over 101 will have a projector and screen. The rooms will include a control system, audio amplification with speakers to provide coverage to the room, and a wireless lapel mic input. It will have the standard inputs/outputs included at the lectern.

F. Multipurpose rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape and size of the room. The rooms will include a control system, audio amplification with speakers to provide coverage to the room if needed, and a wireless lapel mic input. It will have the standard inputs/outputs included.

G. Conference rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape and size of the room. The rooms will include a control system, audio amplification with speakers to provide coverage to the room if needed. It will have the standard inputs/outputs included. This room will require an analog phone line. If this room type has a floor box for the conference table, the table will have one HDMI and one VGA w/sound inputs, along with power and data port at each location where there is a floor box.

H. Study or Meeting rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape and size of the room.

**Standard Equipment:**

All AV equipment must be commercial grade, unless otherwise approved or specified by OIT. All equipment needs to be easily accessible by technicians, either located in a lectern, or in a cabinet, or in an A/V closet. Equipment located in the ceiling, other than the projector, is not acceptable, unless it is located on the projector lift or the projector itself. All equipment that has front panel interfaces, that is not required to be accessed by the presenter, will require the front panel to be covered by a vented security panel or the equipment is located in a locked space. All new AV equipment must have the capability of being remotely managed.

**Equipment Racks:**

Equipment racks are typically 19-inch standard racks. Black, unless otherwise specified in the design and approved by the Office of Information Technology. Racks must be installed in such a manner that allows for proper ventilation of AV gear. No obstructions shall impair the ability for a technician to maintain a safe distance between the back of the rack and the wall. If the rack must be serviced from the front it must have rack rails and sufficient clearance with service loops on all cable.
Projection Screens:

The 16:10 aspect ratio is preferred on all screens installed in classrooms, boardrooms, auditoriums, and learning spaces. All screens will be electronic and be drop ceiling mounted with low voltage controllers. All screens will be powered with control via the control system, and an override wall switch located near the lectern or other controls. If screen is mounted in front of a chalkboard or whiteboard, it will have the proper clearance as to not collide with the installed board. All screens shall be placed in a suitable location as not to obstruct doorways, windows or control pads when in the down position. If a screen must be placed in front of a window, the window will have proper blackout shades installed. All screens shall be at least 48” from the floor when in the down position.

Projection Screens will be sized using the formula: Height of screen equals the distance to the furthest viewer times 0.167, for all rooms except the conference rooms, which will use the formula of: Height of screen equals the distance to the furthest viewer times 0.25.

Multimedia Projectors

Projectors are chosen by the Director of AV and will always be either 3 Chip LCD, DLP High Definition, or Laser projectors. Each will have at least (1) one HDMI ports, (1) one HDBaseT or equivalent digital input (1) one RJ-45 connector, (1) one VGA port, (1) one RS-232 port and Component inputs. Contractors must use proper geometry when placing projectors in the ceiling to ensure complete filling of the screen. Image boarders are expected to be no more than one half of one inch on all four borders. It is preferred that the image fills the screen completely and is plumb to the ground. Images should be at least 48” AFF to ensure a proper viewing line of site from a seated position.

All projectors will be 16:10 native. All video signals will be their native resolution and aspect ratio through the signal chain, and all scaling will be done at the projector.

All projectors will have a minimum rating of 5k lumens and be filter less. All projectors ceiling mounted at a height greater than 10 feet AFF will require the use of a projector lift. The lift will allow the projector to be lowered to at least 5 feet AFF for easy access.

A separate manual switch for the projector mount must be provided on the wall next to the electric screen switch

The projector (and DX Link breakout box, if applicable) will be connected to a remote control power strip (Furman CNMP-15) or similar. This strip will be controlled from the lectern location via a Furman RS-1. This device facilitates troubleshooting by giving the technician the ability to remotely power cycle equipment when physical access to the gear is impossible without the use of a ladder.
Projector Mounts:

White powder coated Chief mounts with lockable devices should be used on all projector installations. The color of the mount and the extension column (if used) must match the ceiling color (typically white or black).

Care must be taken when installing grid mounts near air conditioning returns to ensure minimal vibration from HVAC units. All grid mount projectors must be tethered to concrete substructure from at least 3 points. It is preferred that contractors use flat plate mounts from Chief. They should be secured to the concrete substructure and tethered from at least one point in addition to the plate mount.

If a projector is to be installed on a lift, the lift shall have one switched outlet to prevent the projector from receiving power when the lift is in the “up” position. A constant power outlet will also be provided.

Flat Panel Displays:

All displays are chosen by the Office of Information Technology and must be LCD or LED commercial grade products. Each will have at least (2) two HDMI ports, (1) one RJ-45 connector, (1) one RS-232 port and Component inputs. Every flat panel display will have behind it a four power outlets, 2 connections to the SMU network, and one coaxial connection to the campus QAM cable system. The display must also be built with a recess so that an articulating mount can be installed for easy access. The recess will be at least one inch greater in all directions than the display. It will also be deep enough to hold the articulating mount and the display and still be ADA compliant. All flat panel monitors need to have a QAM tuner included. A sound bar may be required for some monitors depending on specific use case.

Flat Panel Display Mounts:

Flat panel display mounts should be black powder coated Chief mounts. All mounts shall have locking devices or brackets for security. If mounted on sheet rock walls these walls shall have solid wood block backing. This will be specified in the design as to which company is responsible for backing. If the bottom of the display is above 54” from the floor, the mount must be a tilt mount. The mounts must also be articulating for easy access.

Digital Signage:

All displays will have at least (1) network data drop installed in a single gang wall plate specified by SMU’s RCDD Engineers for digital signage. All digital signage will be a Lenovo ThinkCentre computer. Digital Signage appliances will be furnished by OIT but will need to be installed by the contractor (OFCI).
Control Systems and Interfaces:

Control systems and Interfaces must be AMX products with RMS capabilities. Each classroom or learning space must have its own controller and interface. “Daisy chaining” of rooms on a single controller is strictly prohibited. The only time this would be allowed is in a combined room scenario. Interfaces must be at least 48” from the floor if mounted in walls, or in compliance with ADA requirements. It is typical for interfaces to be mounted in the lecterns when possible. This should be discussed in the design phase with the Design and Installation Coordinator. The Director of AV must approve all other control systems.

The control system interface will include either a push button or wired touch panel. Push buttons may be used in rooms that only require some of the following controls, such as projector or monitor on/off, screen up/down, volume up/down, or switching inputs between VGA and HDMI. Wireless touch panels are not to be used.

OIT will have final say in any design of the GUI for any digital control panel.

Switchers:

All switching devices must be from AMX. Video switchers will have at least one vacant digital input and output for future expansion. Switchers must have enough inputs and outputs for the design of the room and work seamlessly with the installed control system. The Office of Information Technology must approve any variation from this standard.

Playback Devices:

All playback devices to include DVD/VCR units, Blu-ray players, computer equipment, document cameras, video recorders etc. are to be approved by the Office of Information Technology. The Office of Information Technology for all AV installations requiring computing equipment will provide PC’s. All playback devices must be controllable by the installed control system with intuitive buttons. In some cases the Office of Information Technology will provide the GUI.

Lecture Capture:

All lecture capture devices must be approved by the Office of Information Technology.

If a video recording /distance learning camera is installed in a classroom, a microphone must be installed in the ceiling above the lecture area. If a wireless microphone is present in the room, its output must be able to be sent to the camera as well.

A user must be able to control the camera thru the AMX touchpad. This includes record, stop, and multiple location options for the presenter.
External AV Input Plates:

All AV wall plates must match the décor of the room and be secured using proper back boxes. The Office of Information Technology and the Office of Facilities Planning and Management will approve these plates in the design phase.

Audio:

These are typically 70v speakers installed in the ceiling of the room. Proper testing of all loudspeakers must take place before installation to ensure the highest quality sound.

Assisted listening devices must be in accordance with ADA section 219.

Sound system functions will be through the control system. Controls will include volume up/down, and will have a mute function. Any audio mixing will be done outside of the AMX Control System. Any room with more than one microphone will have a Shure SCM410 or SCM810.

Any room that has a microphone provided in the design must also have a XLR line in and a XLR line out in that room as well. Both of those should be on the opposite wall of the lectern location.

If the capacity of the room is greater than 50 then a wired microphone must be installed on the lectern. It needs to be a condenser microphone.

If the capacity of the room is greater than 100 then the room must not only have a built in podium microphone but also two separate wireless microphone kits. Shure ULX-D model with rechargeable batteries is preferred. Wireless frequencies will be coordinated with other radio communications equipment.

Cabling:

All cabling must be in compliance with standards set forth by the Office of Information Technology and its RCDD Engineers. Audio cables must be on opposite sides of racks from power cables. All cables must be properly labeled and follow the as builds design. Must use professional standard labels. No masking tape or hand written labels. Contractors must supply enough cable at the rack for service loops. All connectors/connections must be high quality professional standard with no exposed cable beyond the shrink-wrap toward opposite end of connector. Proper testing of cables and connectors shall be performed before connecting AV gear. All fiber runs must be in conduit from point to point. All other cable must be plenum rated if not housed in conduit. It is suggested that all AV cable be in conduit unless otherwise specified by the Office of Information Technology in the design phase.

All Category cables need to be shielded category 6A or better. Any HDMI cable over 10 Meters will require the use of an HDMI equalizer. All other cables will meet current specifications.
All Network equipment used for A/V will need to follow SMU networking standards.

Must have one separate HDMI wire running from the projector to the wall closest to the lectern. This will be a backup cable in case the built-in system fails.

The DXLink cable from the lectern to the Enova will be green, and will connect to the wall via an Ethercon locking connector. This prevents accidental disconnection of the DXLink, and accidental connection of the PoE signal to non-PoE devices.

**Lecterns:**

The Office of Information Technology in conjunction with the Office of Facilities Planning and Management must approve lecterns.

The lectern will have an AV rack built into the bottom. It will need to have a rack mount power conditioner with a front outlet for a guest laptop. The power strip must not have an on/off switch on its front.

There will be installed in the rack a Furman RS-1 relay controlled power supply that is controlling the power at the projector mount.

There will be a VGA and HDMI connection for a guest laptop.

There must be a 1/8” audio input for laptop. This audio input must be setup that it doesn’t have to follow video.

There will be a power strip for all AV equipment, with a front panel outlet, but without a switch. Middle Atlantic model PD-915R-PL preferred

**Lighting:**

All room lighting within ten feet of either the projection screen or flat panel monitor must be on a separate circuit, to prevent wash out. There must be a lighting control on the AMX touchpad as well as the wall.

**Commissioning, Inspection and Testing:**

It is the responsibility of the AV contractor to provide a commissioning and inspection schedule prior to the installation of all equipment. Final testing shall take place with the AVIT Systems Team Lead present to ensure all equipment is functioning properly and signed off before commissioning the system.
Training:

The AV contractor is to provide a schedule for complete system training for end users and Support Services Staff after the system commissioning. This should be no less than four hours of complete hands on training with qualified personnel.

AV Design:

All A/V infrastructure designs, plans, and equipment will need to be reviewed and approved by the Director of Audio Visual and Event Support in conjunction with the Office of Facilities Planning and Management. Requests for Information on AV related items can be addressed to the same team.

AV Closets:

A dedicated AV closet at least 64 square feet on each floor of the building for all new construction will be determined on a case by case basis. The AV closet cannot share space with IDF’s or BDF’s.

Warranty:

All products to include hardware and software supplied by the AV contractor must be free of defects for a period of one year from the date of commissioning. This warranty period shall include all labor costs and shipping associated with replacement of faulty items to include programming costs. Vendor must respond within a 24 hour period unless default happens on a weekend in which case a follow up the next business day is acceptable. If a replacement part should take longer than 48 hours to procure, vendor will provide a suitable replacement part to keep system up and running.

PART 2 - PRODUCTS

2.1 GENERAL

A. The classrooms are divided into different categories depending upon the number of students that the room can accommodate and the specific use of the room. The rooms are broken down into 8 different sizes and use. The different types are: Seminar, Classroom seating up to 25, Classroom seating 26 to 60, Classroom seating 61 to 100, Classroom seating over 100, Multipurpose room, Study or Meeting room, and Conference room.

B. All Audio Visual components must be commercial grade hardware. All equipment needs to be easily accessible by technicians, either located in a podium, or in a cabinet, or in an A/V closet. Equipment located in the ceiling, other than the projector, is not acceptable, unless it is located on the projector lift. All equipment that has front panel interfaces, that is not required to be accessed by the presenter, will require the front panel to be covered by a vented security panel or the equipment is located in a locked space. All new AV equipment must have the capability of being remotely managed. SMU has an unlimited number of license for AMX’s Room Management System, RMS. Any podiums or lecterns need to
have space to store the A/V equipment used for that room, and where a monitor is required, will have a flat top, or will have to use a monitor arm.

C. Seminar rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape of the room. The Seminar room will include a control system, audio amplification, and a wireless lapel mic if lecture capture is required. This room will have the standard inputs/outputs included, either on the wall, or at the podium. Tables should be movable to facilitate different teaching styles.

D. Classrooms seating up to 25 will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape of the room. The rooms will include a control system, audio amplification, and a wireless lapel mic input if lecture capture is required. It will have the standard inputs/outputs included, either on the wall, or at the podium.

E. Classrooms seating between 26 and 60 will have a projector and screen. The rooms will include a control system, audio amplification with speakers to provide coverage to the room, and a wireless lapel mic input. It will have the standard inputs/outputs included at the podium.

F. Classrooms seating between 61 and 100 will have a projector and screen. The rooms will include a control system, audio amplification with speakers to provide coverage to the room, and a wireless lapel mic input. It will have the standard inputs/outputs included at the podium.

G. Classrooms seating over 101 will have a projector and screen. The rooms will include a control system, audio amplification with speakers to provide coverage to the room, and a wireless lapel mic input. It will have the standard inputs/outputs included at the podium.

H. Multipurpose rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape and size of the room. The rooms will include a control system, audio amplification with speakers to provide coverage to the room if needed, and a wireless lapel mic input. It will have the standard inputs/outputs included.

I. Conference rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape and size of the room. The rooms will include a control system, audio amplification with speakers to provide coverage to the room if needed. It will have the standard inputs/outputs included. This room will require an analog phone line. If this room type has a floor box for the conference table, the table will have one HDMI and one VGA w/sound inputs, along with power and data port at each location where there is a floor box.

J. Study or Meeting rooms will have either a flat panel monitor (preferred) or a projector and screen, depending upon the shape and size of the room. The rooms will include audio amplification with speakers to provide coverage to the room if needed. It will have the standard inputs/outputs included.

K. Projection Screens will be sized using the formula: Height of screen equals the distance to the furthest viewer times 0.167, for all rooms except the conference rooms, which will use the formula of: Height of screen equals the distance to the furthest viewer times 0.25. All screens will be powered with control via the control system, and an override wall switch
located near the podium or other controls. Screens are to be mounted so projected image is a minimum of 4 feet above the floor.

L. All projectors will have inputs for both digital (HDMI) and Analog (VGA with sound) directly, or through the use of a scaler or switcher. All projectors will have a minimum rating of 5K lumens, will be filterless and have a full 16:9 (1920 X 1080) resolution. All projectors mounted at a height greater than 10 feet AFF will require the use of a projector lift mount. The lift will allow the projector to be accessed for maintenance with the use of a standard six foot ladder.

M. All flat panel monitors should be size similar to the projector screens. All monitors should be either LED (preferred) or LCD monitors. All flat panel monitors need to have a QAM tuner included. Any monitor larger than 50 inches, or 50 pounds, needs to have blocking in the wall to support the monitors. A sound bar may be required for some monitors depending on specific use case.

N. The control system interface will include either a push button or wired touch panel. Push buttons may be used in rooms that only require some of the following controls, such as projector or monitor on/off, screen up/down, volume up/down, or switching inputs between VGA and HDMI. Wireless touch panels are not to be used.

O. Sound system functions will be through the control system. Controls will include volume up/down, and will have a mute function. Speakers should be mounted in the ceiling, and not hung on the walls.

P. The following inputs/outputs need to be included in the design of all rooms. VGA, 3.5 Audio, three HDMI inputs, and XLR.

Q. All Category cables need to be Cat6 or better. Any HDMI cable over 10 Meters will require the use of an HDMI equalizer. All other cables will meet current specifications.

R. The lighting zone near the screen or monitor will have a separate switch to dim or turn off the lights, to prevent washout of the displays.

S. All A/V infrastructure designs, plans, and equipment will need to be approved by the Office of Information Technology (OIT) Support Services A/V Support Installation Team. Requests for Information on AV related items can be addressed to the same team.

T. All Network equipment used for A/V will need to follow SMU networking standards.
PART 1 - GENERAL

1.1 SUMMARY

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section references provision and/or coordination of related material and services

C. SMU has unlimited licenses of Nexus App Space, the application that SMU uses for digital signage content and display. This application is managed by OIT and any information required about the application can be provided by OIT.

PART 2 - PRODUCTS

2.1 GENERAL

A. Display Monitors. The size of the display monitor will depend upon the size of the area that it is installed in. Normally a 46 inches monitor would be the smallest monitor that should be installed. The monitor will need to have an HDMI input as well as a QAM tuner.

B. Mounting Hardware. The wall or ceiling mount will be of the type that will best allow for viewing of the monitor, either a tilting or articulating mount, depending upon the location. The Mount will allow for a lock to be installed to secure the monitor.

C. Nexus Players. The Nexus player will be purchased and provided through OIT. Any software that is required for the normal operation of the player will be installed by OIT. If the Nexus player is installed at the monitor location, then a wall mount for the player will need to be installed by the contractor behind the TV. This wall mount will be provided by OIT.

D. Electrical Power. Electrical power will be installed by contractor. Needed will be a single gang 110V outlet to provide power to both the monitor and player. If other equipment will be installed at this location, that needs power, another outlet or a dual gang box needs to be supplied.

E. Wall blocking for monitor mount. Wall backing or other support will be installed when the monitor is over 50 inches or over 50 pounds.

F. Cabling for player and monitor. The Nexus player will require one network connection and power at the installation point of the player, normally at the monitor. For future expansion, a network connection should be installed for the monitor location along with a coax cable for Cable TV. If the player is not installed locally at the monitor, a Category 6 Ethernet cable
must be installed to transmit video/audio to the monitor from the player if the cable distance is over 15 meters. Cable length under 15M can use an HDMI cable. All Cables will meet SMUs specifications.
INTERIOR ROOM SIGN

SPECIFICATIONS

| SCALE: 3/4 | MATERIAL: 1/16" NON-GLARE & 1/16" CLEAR ACRYLIC |
| APPLICATION: POLYMER WITH WINDOW LAMINATED WITH .020 METAL POLYMER 2" X 6" |
| FORMAT: CENTER SIZE: 6" X 6" ACRYLIC |
| LETTER FONT: AVENIR LT STD 55 RMN 1/16" ACRYLIC SPACERS |
| LETTER COLOR: WHITE COLOR: TO BE SELECTED BY SMU |
| LETTER SIZE: 1" SURFACE PAINT |
| INSERT: BY CUSTOMER MOUNTING: |
| FOAM TAPE & SILICONE |

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Graphics, Signage, and Way finding  
B-6A - 1
Laboratory Design Guide

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A. General Approach

Laboratories are an integral part of Southern Methodist University’s mission. The utmost care must be undertaken during design and construction to meet the needs of the academic department and the technical requirements set forth. It is critical that ample time be set aside for the design and construction of a laboratory and that all appropriate parties are involved. Laboratory design should be reviewed with the Project Manager and the academic department/client to determine programmatic needs and parameters.

There are different requirements for teaching and research laboratories depending on the type of research or educational functionality of the laboratory. Detail is extremely important to the success of laboratory space; it is incumbent upon the Designer to ascertain the needs of the various laboratory types in a project, to thoroughly understand the requirements for the systems to be incorporated into the laboratories, and to detail the space around those needs and requirements.

It is extremely important to establish parameters for energy consumption and utility services during the pre-design phase of the project. The Project Manager will meet with the academic department/end user, the Design Team and Facilities Engineering and Campus Energy to establish these parameters which will be included in the Basis of Design.

Any codes and guidelines referred to in the document are not to be assumed as comprehensive. It is incumbent upon the Designer to properly investigate the specific requirements of the lab to ensure compliance with all local, state, and national codes and regulations.

Early in the programming phase of the project, the Project Manager will involve appropriate parties during design and construction meetings. Appropriate departmental representatives, including the faculty or staff member that will oversee the lab, as well as Environmental Health and Safety, the Office of Research and Graduate Studies, Facilities Maintenance and Grounds, Facilities strategic partners, the Office of Information Technology, and the Office of Research and Graduate Studies may all need to be involved in these meetings.

B. Space Requirements

1. Layout – General Requirements

   - Laboratory space should be separate from offices and common space. Laboratories should be oriented such that a common service corridor can serve two laboratories (lab, service corridor, lab)
   - Occupants must not have to go through a laboratory space to exit from non-laboratory areas.
- Fire-rated hallway doors should have magnetic hold-open devices
- Each door from a hallway into a lab should have a view panel and be at least 36” high
- Mechanical and electrical devices shall be readily accessible
- Laboratories should be oriented to take advantage of natural lighting (with consideration for controlling sunlight and glare).

2. Construction Materials

- Steel Sheet: commercial-quality, cold-rolled, carbon-steel sheet, complying with ASTM A 366; matte finish; suitable for exposed applications; and stretcher leveled or roller leveled to stretcher-leveled flatness
- Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher leveled, No.4 finish.
- Glass-fiber Reinforced Polyester: Polyester laminate complying with ASTM 04357, with a chemical-resistant gel coat on the exposed face, and having a flame-spread index of 25 or less when tested according to ASTM E 84.
- Epoxy: Factory-molded, modified, epoxy-resin formulation, uniform mixture throughout, full thickness with smooth, nonspecular finish.

C. Finishes

1. Walls and Doors

There is no ‘standard’ laboratory wall material or finish, but the Designer must finish the facility in a way that allows for normal cleaning, upkeep, and maintenance. In any “wet” laboratory the preference is for mold resistant gypsum wall board. Doors must be provided with a visual window of at least 36”.

2. Floors

Wet chemical laboratories shall have chemically resistant flooring that is compatible with the planned use of the space. This flooring should extend into hallways and corridors that service the laboratories. This flooring must be seamless and compatible epoxy flooring is preferred.

Floor penetrations for electrical, plumbing, and mechanical services shall be completely and permanently sealed prior to applying finish flooring.

Flooring must be level with no floor drains with the following exceptions:

- Areas with safety showers must have flooring pitched to the drain.
- Floors in predominantly wet areas shall be non-slip and floor drains are required.
Floor penetrations for electrical, plumbing, and mechanical services shall be completely and permanently sealed prior to applying finish flooring.

3. Windows

Review need for sunlight filtering in laboratories. Natural lighting is desirable but some laboratory configurations may necessitate low lighting conditions. Windows should be non-operable and equipped with shades to block out light when necessary.

D. Furniture and Fixtures

All laboratory shelving shall be securely attached to walls or other supporting surface, not extend higher than 6 feet above the floor, and shall have lips, doors, or other means to prevent materials from inadvertently falling off. Materials of construction shall be compatible with any chemicals intended to be stored on the shelves, and shall exhibit appropriate strength to safely support materials intended to be stored on such shelves. Laboratories shall, when applicable, be provided with sufficient lockable cabinets for storage of specifically regulated materials, such as DEA controlled substances, radioisotopes, particularly hazardous chemicals, and Select Agents.

Work surfaces should be chemical resistant, smooth, and readily cleanable. Work surfaces, including computer areas, should incorporate ergonomic features, such as adjustability, task and daylighting conditions, and equipment layout.

Laboratories shall be provided with at least one sink for handwashing with both hot and cold water supplies. Handwashing sinks for particularly hazardous chemicals or biological agents may need elbow or electronic controls. In addition, each sink shall have an eyewash station installed at the sink.

Benchwork areas should have knee space to allow room for chairs near fixed instruments. Casework in Teaching Laboratories shall conform with ADA requirements. Casework in non-teaching (research) laboratories shall be adapted to the requirements of the individual users.

Limit the number of cup sinks in the laboratory (including in fume hoods) in order to avoid dry traps and the ensuing odors.

Ensure autoclaves have adequate space for use, maintenance and materials storage.

E. Lighting

1. General

Daylighting shall be maximized where possible for user comfort. Lighting should be even across the room, with a maintained light level for work surfaces in accordance with IES standards. Non-laboratory space shall also follow IES standards.
combination of lighting zones, dimmable fixtures, and controlled daylight in the room is ideal. Fixtures should control glare and should not produce veiled reflection in the room or on equipment. Indirect/direct fixtures are favored.

If a space has a ceiling above 12’ in height, the project team shall review all access requirements for light fixture maintenance and incorporate any fixed requirements such as access panels, cat walks, etc. into the documents.

2. Special Features

Much of the public space lighting on the University campus is controlled by occupancy sensors. Typically, at least one light in a space will not be controlled by the sensor but will be on an emergency circuit (review this requirement in rooms that are to be totally blacked out for projection). The occupancy sensor is to be wired so that it can be bypassed with a conventional light switch. If occupancy sensors are to be included in a project, the operation should be carefully coordinated with the room use. Occupancy sensors should include additional contacts for integration with HVAC systems.

3. Lighting Types

For instructional spaces (as with interior lighting in general) energy efficient lighting is standard for SMU. Indirect/direct lighting is preferred for its even quality. For any needed downlighting or highlighting, LED energy efficient fixtures are campus standard. No halogen lighting may be specified. Where possible at bench locations, under cabinet/shelf task lighting is preferable.

To minimize the need for storing a large variety of replacement lamps, Designers should (if fluorescent lamps are used) attempt to use two- and four-foot tubes as a standard, and PL tubes with a common base configuration throughout a project.

40 fc minimum ambient light levels to be provided in labs. Supplemental under-cabinet and standalone task lighting is to be supplied as necessary to support proposed space program. Take into account the location of overhead lighting and position of user in the room. Light levels on bench/work surface to meet the 40 ft candle requirement without shadows being cast by occupant at bench.

F. Storage

1. Cabinets for chemical storage should be of solid, sturdy construction and vented as required. All chemical storage must meet applicable codes and standards.
2. Flammable liquid storage is not typically allowed below grade or near a means of egress; refer to applicable codes.
3. The International Fire Code imposes limits on the quantity of chemicals stored in a building. There are individual limits for each of various types of chemicals, including flammable liquids, gases, acids, oxidizer, poisons, etc. The storage limit quantities are
also based on location, such that storage is more limited below grade and above the ground level.

4. Hazardous material cabinets are required to be self-closing and self-latching.

5. Laboratories using compressed gases should have areas designated for cylinder storage and be equipped with devices to secure cylinders in place. Appropriate signage at remote cylinder storage should note via text and/or plan areas being served. In addition, gas turrets should indicate source location of remote cylinder storage.

6. Provide space for chemical waste collection containers other than in fume hoods and sinks.

7. Provide space for storage of supplies and combustible materials, e.g., boxes of gloves, spill kits, boxes of centrifuge tubes, etc.

8. All minus 20 and minus 80 refrigeration units must be wired to include a Siemens-installed remote monitoring system.

9. Appropriate fire extinguisher locations (such as Class ABC or Class D) shall be included in the design.

10. Specialty fire suppression systems must be reviewed by SMU Emergency Management.

G. HVAC / Plumbing

1. Ventilation rates are typically 6-10 air changes per hour minimum for occupied spaces and 4 air changes per hour minimum when unoccupied, but may vary based on room use/program.

2. Variable air volume (VAV) systems are preferred in laboratories.

3. Unless otherwise specified (e.g., clean rooms), air pressure in the laboratory should be negative with respect to the outer hallways and non-laboratory areas.

4. If a space has a ceiling above 12’ in height, the project team shall review all access requirements for HVAC equipment maintenance and incorporate any fixed requirements such as access panels, cat walks, etc. into the documents.

5. Acid waste pipe for drain-waste-vent (DWV) shall be Orion (Blue) pipe or Charlotte ChemDrain. Heat welded when concealed in walls, heat welded or mechanical fitting where exposed in labs.

6. Duct and piping risers to be in separate accessible shafts. Plumbing riser shafts to have a structural floor infill at each level.

H. Fume Hoods


2. All fume hoods shall be selected to operate with an exhaust system with a remote fan with redundancy. Fume hoods shall not be selected to operate with local motors.

3. All fume hood purchases and installations must be approved by Environmental Health and Safety (EHS).
4. Variable air volume (VAV) fume hoods shall be used, unless there are sound reasons to not do so (e.g., if there are only a few hoods and energy savings would not be achieved, or for dedicated single-ducted hoods). In those cases where VAV hoods cannot be used, constant air volume hoods with by-pass air openings shall be used. All hoods shall be equipped with sash stops on vertical rising sashes allowing the sash height to be set at 16” during routine use, unless there are sound reasons to use another sash height.

5. VAV fume hood labs shall be controlled such that higher air changes per hour are used during occupied times. At unoccupied times, the number of air changes per hour shall be reduced. These rates shall be established per ANSI/AIHA Z9.5 – 2012 standards. An emergency purge button shall be installed in every lab in the most accessible place to activate an emergency purge if there is an outside of the fume hood spill.

6. All chemical fume hoods shall be Labconco Premier or equivalent.

7. Fume hoods used primarily for with acids must be rated for acid use and include a washdown system. These hoods shall also be Labconco Premier Acid-use hoods or equivalent.

8. Perchloric hoods shall have 316 welded stainless steel ductwork with a complete, freeze proof, wash down system and hood mounted with on-off control at the hood. Perchloric systems shall operate at a sound level below OSHA’s 8-hour threshold sound power level that requires hearing protection. Spray system shall be zoned as required for proper cleaning. Perchloric hoods shall have an on-off switch. Keep the use of these hoods to a minimum and isolate from main areas in building. Restricted bypass style fume hoods should only be used in laboratories with constant volume exhaust systems.

9. Hoods shall have an Auto-Sash closing device and a face velocity of 60 – 100 linear feet per minute with the auto-sash fully open or at its standard configuration (e.g., at the stopper height). Occupancy sensor setback should be considered in non-auto-sash closing hoods.

10. The location of fume hoods, supply air vents, operable windows, laboratory furniture and pedestrian traffic should encourage horizontal, laminar flow of air into the face of the hood, perpendicular to the hood opening. Hoods should be placed away from doors and not where they would face each other across a narrow isle. Air velocity caused by supply vents should not exceed 25 feet per minute at the face of the hood. Locate supply diffusers far enough away from hood to avoid draft disturbances at face.

11. Each hood must have Siemens controls monitoring device and emergency purge button. The panel must have audible alarms. The alarm shall be set at 80fpm unless specific approval is received from EHS.

12. Noise from the fume hood should not exceed 65 dBA at the face of the hood.

13. Fume hood exhaust ducts should be metal and not contain fire or smoke dampers.

14. While ductless fume hoods are not advised, EHS recognizes that there are some cases where they may be necessary. Hoods requiring filters should be designed and located such that filters may be accessed and changed easily. Single vertical sliding sashes are preferred over horizontal or split sashes.

15. Debris screens should be accessible and placed in the hood exhaust plenum.
16. Fume hoods should have recessed work surfaces to control spills
17. Receptacles shall be GFCI, standard.
18. Consider alternative to fume hoods based on the intended operations. Ventilated enclosures, glove boxes, nanotechnology benches, downdraft tables, slot hoods and fume extractors may be effective and more energy-efficient.

I. Eyewash & Safety Showers

All Eyewash & Safety Shower locations must be reviewed and approved by EHS.

1. Laboratories using hazardous materials must have an eyewash and safety shower within 55 feet or 10 seconds travel time from the chemical use areas.
2. Installations must meet ANSI Z358.1-2014 Standards (See ANSI Guide)
3. Showers must provide a flow rate of 20 gallons per minute for 15 minutes.
4. Eyewash stations must provide 3 gallons of water per minute for 15 minutes.
5. Water temperature must be between 60 and 100 degrees Fahrenheit.
6. Eyewashes and safety showers are to have plumbed drains, unless approved otherwise by EHS. Floors shall be sloped to drains.
7. Eyewashes and safety showers should be standardized within a laboratory building.
8. Flooring under safety showers should be slip-resistant.
9. Discuss requirement for privacy curtains at safety showers.
10. Safety Showers shall be piped with tempered water; use Lawler 911 mixing valves or equivalent.
11. Safety showers and eyewash stations must have hands-free stay open valves.

J. Lasers, Power, and Alarms

1. Utility shut-off controls should be located outside the laboratory.
2. Environmental chambers where evacuation or other alarms cannot be heard should be equipped with strobe lighting or additional alarms.
3. Environmental Chambers should include Siemens-installed remote monitoring systems where applicable.
4. The requirements for monitoring and control of Laboratories using highly toxic gases shall be reviewed with EHS.
5. Any laboratory with gas storage (i.e. liquid nitrogen) that can displace oxygen must be outfitted with a Siemens-monitored oxygen sensor.
6. Include illuminated “Laser in Use” signs at all entrances to labs with lasers.
7. Laser laboratories must be built with an interlock system, preferably designed by Kentek.
8. Laboratories with lasers and/or high voltage equipment should have an emergency power-off switch installed near the laboratory exit and not over the laser table.
9. Laboratories should have a sufficient number of electrical receptacles to eliminate the need for extension cords and multi-plug adapters.
10. Each laboratory shall have a dedicated panelboard located in an unobstructed accessible area.
11. Typically the University does not supply standby or emergency power for academic research. The need for special circumstances should be reviewed early in the design process with Facilities Engineering and Campus Energy.

K. Security

Review the need for security control of laboratories with the Project Manager. All laboratory new builds and renovations must include card access protocols as a standard practice.

Laboratories classified by Environmental Health and Safety as needing additional security (high value equipment or security-sensitive materials) may require additional security measures such as intrusion alarms, cameras, etc.

L. Clean Rooms

The use of a Design – Build vendor for clean rooms is preferred. This sub consultant to the primary designer approach is a function of the clean room requirements. The Designer shall coordinate all furnishings and equipment with the Design - Build vendor.

M. Animal Care and Use Facilities

Animal care and use areas must meet Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International guidelines. This includes guidance on materials of construction, ventilation design, security and more.

Any renovation or new construction to house or study animals used in research need to be planned with the research and the animals in mind. Principal Investigators (PI’s), the Attending Veterinarian, and the Director of Research Compliance need to be involved from the earliest concepts to the detailed planning. Since regulatory oversight of all research activities, including housing of animals, has to be approved by the Institutional Animal Care and Use Committee (IACUC), that committee should also be consulted from design until commissioning. Depending on the species, multiple regulations and/or guidelines may apply. While AAALAC has an excellent Handbook of Facilities Planning, many other guidelines exist for classical laboratory animals, birds, fish, farm animals, exotic animals, wildlife and others. Additional concerns when building animal care space is occupational health and safety of animal care staff and research personnel, as well as different levels of bio-containment or bio-exclusion of the species and type of research being conducted. Special consideration needs to be given to space for storage and logistics and separation of clean and dirty traffic flows and impact on the surrounding activities.
N. Radioactive Materials Laboratories

For laboratories using radioactive material

1. Eating and drinking areas must be physically separated and conveniently located.

Consider designing the laboratory to allow separation of radioactive materials use from other laboratory spaces

O. Equipment UL Labeling

All hardwired equipment is required to be UL labeled or equivalent. Coordinate any non-UL labeled equipment with the Project Manager, Facilities Engineering and Campus Energy and the University Code Analyst. *Testing and Labeling may be required.*

P. Off Hour Alarm Management (Remote Notification)

Alarms that require off hour response need to be set up to notify appropriate personnel via email and phone call. A meeting with the appropriate users shall determine which alarms require off hour response and where the appropriate notifications will be sent.