City of Fort Collins
Operation Services

BUILDING
DESIGN & CONSTRUCTION
STANDARDS

October 1, 2013 | Edited: 2025

City of Fort Collins

FOR ASSISTANCE VIEWING OR READING ANY CITY DOCUMENTS,

please call 970-221-6515 (V/TDD: Dial 711 for Relay Colorado) for assistance or contact the City's ADA Coordinator via email adacoordinator@fortcollins.gov or phone: 970-416-4254.

A Request for Reasonable Accommodation can also be completed online.

For more information about the City's Non-Discrimination policy and Accessibility efforts, visit fortcollins.gov/Non-Discrimination.

TABLE OF CONTENTS

INTRODUCTION

7/25

1.01 INTENT AND PURPOSE

The City of Fort Collins (Owner) contracts for the design, repair, alteration, construction, deconstruction, and maintenance of City and Allied Agency owned buildings. Owner also provides workspace design and furniture procurement for its facilities and departments.

The Building Design & Construction Standards (BDCS) is a mandatory standard prepared by the Operation Services Department. The BDCS apply regardless of the funding source and are not a guideline nor substitute for technical competence. The BDCS must be used in conjunction with governing standards referenced in this document, as well as the most current codes, requirements, and program for each project. If conflicts exist between the BDCS and a specific program or project requirement, contact the Projects Project Manager for the specific project for resolution.

1.02 USE OF THE DOCUMENT

The BDCS has moved to a more performance-based set of requirements. A large portion of the BDCS has specified a level of performance allowing the project team, Professional Partners and Design Consultants (Consultants) to identify and implement the best strategies to meet the project goals. The BDCS are also not to be construed as limiting creative design or functional and economic considerations, but to assist Consultants by providing uniformity for all Owner facilities and thereby assist the Owner in their effort to standardize facilities and facilitate ease of maintenance as administered by Operation Services Department.

The BDCS are to be used as a basis of design for Consultants providing project documentation for Owner projects. The BDCS are presented in CSI MasterFormat but are not to be copied and used by Consultants as their project specifications. Consultants are to create their own specifications and design for each project utilizing the information, requirements, products, etc. as provided in the BDCS. Consultants assume full professional responsibility for research, design, architecture, engineering, regulatory compliance, and other requirements defined by statutes and prevailing standards of professional care. If specific products are identified in the BDCS, they are intended to provide a level of quality and acceptable minimum criteria. It is the responsibility of the Consultant, Contractor, or Architect/Engineer to verify all listed products and criteria are applicable for the design solution under consideration by the design professional and/or contractor. Should any information or item contained in this document be contrary to current policies, practices and/or materials, it is the responsibility of the Consultant or Contractor to inform the City of such items and provide information on alternatives.

Links to documents, websites, and other information are provided for convenience. It is the Consultant's responsibility to use the current reference or information at the time of project solicitation and/or conception.

1.03 ENVIRONMENTAL

Owner has established general environmental goals for design and for construction of projects. Contractors, subcontractors, suppliers, and manufacturers (construction team) are encouraged to participate where possible to realize the Owners' environmental goals. The Intent is for environmental goals to be achieved in a manner that provides for a safe and healthy environment for building occupants with minimal impact on the environment. Environmental goals shall meet or exceed the current LEED standard and the Owners code amendments regarding green building. Buildings or renovations over five thousand (5,000) square feet must meet a minimum of LEED Gold. The BDCS are not intended to limit alternative means of achieving environmental goals. A team approach and suggestions from the construction team for implementing goals are encouraged.

Buildings are to be designed to earn **Energy Star certification**. This must be coordinated with the City of Fort Collins Energy Manager.

1.04 ACCESSIBILITY

The Owner is a Title II (2) entity and must comply with all Americans with Disabilities Act (ADA) requirements. This also includes the requirement to follow ICC A117.1 as required by the City of Fort Collins Building Services Department. The Owner intends to be as inclusive and accessible as possible. Therefore, we require that design teams go above the minimum dimensions and design spaces to be usable by individuals that utilize a variety of mobility devices, including but not limited to manual wheelchairs and electric wheelchairs. All new construction and renovations will strictly adhere to dimensional requirements set forth by the ADA and will not allow exception for construction tolerances on ADA dimensions. For example, the operable part of a light switch must be less than forty-eight inches (48) AFF. If the operable part is installed at 48.25 inches, it will be required that the contractor and design firm under contract correct the problem and lower the switch.

The installation of all materials, components, devices, and fixtures shall be installed compliant with ICC A117.1 and ADA requirements.

1.05 HISTORIC PRESERVATION

Projects impacting historic properties must comply with the Owners historic requirements. Coordination with the Historic Preservation department is also required.

1.06 RECOGNIZED CODES AND STANDARDS

All work is required to meet or exceed the applicable Codes and Standards adopted by the Authorities Having Jurisdiction (AHJ). If a conflict exists between the BDCS, the Codes and Standards adopted by the AHJ's take precedence.

1.07 CODE COMPLIANCE

All projects are required to be submitted for the appropriate permits and entitlements. The Consultant and Contractor shall be responsible for submission requirements for all projects.

1.08 HEALTH AND SAFETY REQUIREMENTS

Alterations of occupied spaces must include the removal of all asbestos containing materials (ACM). A pre-alteration assessment must be conducted on the portion of the facility that will be affected by the renovation or deconstruction operations to inspect and evaluate the presence and condition of any ACM. Coordination with the City of Fort Collins Environmental Department is required.

1.09 FALL PROTECTION

All locations, both indoor and outdoors, where routine work is expected to be performed and elevations above four (4) feet must be addressed for the feasibility of including permanent work access.

1.10 BUILDING INFORMATION MODELING (BIM)

BIM may be required on specific Owner projects. Computer based modeling programs are an industry standard method of design and an essential means of project delivery. Owner encourages the use of virtual reality and other imaging and presentation techniques during the initial concept phases to allow all participants to understand the qualities and benefits of a particular design.

1.11 MODIFICATIONS

The BDCS are a living document that will be updated and improved. To furnish the most complete and reliable data for Owner projects, this document has been formatted to accommodate record keeping for all revisions. Each section will include a month and year date (i.e., 7/25) immediately below the section title to indicate the month when something within that section was updated and provide ease of identifying the most current version. It is the user's responsibility to check to make sure they have the latest version.

Deviations require an approved modification. Project teams seeking relief from requirements must establish the technical hardships that make compliance impossible. Alternatively, requests for modifications may demonstrate that non-compliance is life cycle cost beneficial. Budget and/or time constraints are not technical hardships and will not be considered. Deviations must be requested in writing.

The Director of Operation Services, or designee, will own this document and will manage the modification process. The Director of Operation Services, or designee, will be the sole individual who is authorized to make the final decision on any changes, modifications, or updates. The master version of this document will reside with the Owner.

1.12 ALTERNATIVE AND EQUIVALENT COMPLIANCE

The Owner encourages the development of new and innovative building systems. The provisions of the BDCS are not intended to prohibit the use of alternative systems, methods, or devices not specifically addressed. The use of alternative systems, methods, or devices is permitted to meet the intent of the prescribed requirements where approved as being equivalent. All technical documentation for alternatives must be submitted and approved prior to final concept submission. Proposed alternatives must be equivalent or superior to the BDCS concerning quality, cost, strength, effectiveness, fire resistance, durability, efficiency, and safety. All proposed alternatives must be accomplished within the project budget and schedule. The use of an alternative and equivalent compliance method is not to be considered a waiver from any Code, Standard, or other requirement.

Any individual department can propose a change to the BDCS. Changes should be submitted in writing, along with the justification for the change, to the Director of Operation Services. The proposed changes will be presented to a committee, consisting of representatives from Operation Services Project Management, Planning and Design (PMPD), Facilities Maintenance, Systems Control, and the Director of Operation Services. If the majority agrees, the change will become part of the standards.

1.13 ABBREVIATIONS

The following abbreviations are listed:

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG ADA	Accessibility Guidelines – Buildings and Facilities
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
AIA	American Institute of Architects
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute

APA	American Plywood Association
ARI	Air Conditioning & Refrigeration Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers
ASLA	American Society of Landscape Architects
ASM	American Society of Metals
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing & Materials
AWA	American Plywood Association
AWC	American Woodwork Council
AWI	Architectural Wood Institute
AWPA	American Wood Protection Association
AWS	American Welding Society
BDCS	Building Design and Construction Standards
BIM	Building Information Modeling
CPSC	Consumer Product Safety Commission
CSI	Construction Specifications Institute
DDC	Direct Digital Control
EPA	US Environmental Protection Agency
ETL	Electrical Testing Labs
EWA	Engineered Wood Association
IBC	International Building Code

ICBO	International Conference of Building Officials
ICC	International Code Council
IECC	International Energy Conservation Code
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IFC	International Fire Code
IMC	International Mechanical Code
IPC	International Plumbing Code
LEED	Leadership in Energy & Environmental Design
MFMA	Maple Flooring Manufacturers Association
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NCMA	National Concrete Masonry Association
NCPWB	National Certified Pipe Welding Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NOFMA	National Oak Flooring Manufacturer's Association
NRC	Noise Reduction Coefficient
NWFA	National Wood Flooring Association
NWWDA	National Wood Window & Door Association

OFCI	Owner Furnished, Contractor Installed
OSHA	Occupational Safety and Health Association
PCA	Portland Cement Association
PMPD	Operation Services Project Management, Planning, and Design Division
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SRI	Solar Reflectance Index
STC	Sound Transmission Class
TCA	Tile Council of America
TARR	Texture Appearance Retention Rating
UL	Underwriter's Laboratories, Inc.
VOC	Volatile Organic Compound
WWPA	Western Wood Products Association

END OF INTRODUCTION

DIVISION 00: Procurement and Contracting Requirements

5/25

END OF DIVISION 00

DIVISION 01: General Requirements

01 11 00 – SUMMARY OF WORK

7/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for the summary of work. Additional requirements may be included within specific agreements or other contracting documents.

B. Design and construction shall, at a minimum, conform to or exceed the minimum applicable standards of the City of Fort Collins Zoning and Building Codes, City of Fort Collins Green Building Code, the Fort Collins' Energy Code for commercial, industrial and high-rise residential buildings, Fort Collins' City Plan, City of Fort Collins Sustainable Standards (Minimum LEED Gold), Larimer County Health Department (Typically applicable to commercial kitchens), ICC A117.1, Public Right of Way Accessibility Guidelines (PROWAG), Americans With Disabilities Act (ADA) , and other City of Fort Collins Departmental Standards.

C. With respect to additional governing jurisdictional authorities, they shall be referred to as supportive and/or in addition to the City Building Code requirements when applicable. The following authorities shall be considered in any given project design:

1. Poudre Fire Authority (PFA).
2. Larimer County Health Department.
3. City of Fort Collins Community Planning.
4. City of Fort Collins Utility Services.
5. City of Fort Collins Historical and Cultural Services.
6. City of Fort Collins Transportation Services.
7. Poudre River Library District (Poudre Libraries).

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Refer to RFP or bid documents for scope of work in relation to a specific project.

1.04 OCCUPANCY OF PREMISES

A. Buildings may be occupied during the performance of work. Before work starts, arrange with the Owners Project Manager a sequence of procedures, means of access, space for storage of materials and equipment, and use of approaches, corridors, stairways, and parking areas

B. Existing buildings and their contents must be always kept secure. Provide temporary closures as required to maintain security as directed by the Owner's Project Manager.

1.05 UTILITIES

A. Obtain all required permits and conduct all investigations prior to the start of excavation. Contact all utility locating services a minimum of forty-eight (48) hours prior to excavation to mark utilities and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract documents, within area of work.

B. Utility cutovers and interruptions shall be coordinated with the Owner's Project Manager.

1.06 NOTIFICATION PRIOR TO EXCAVATION

A. Notify the Owner's Project Manger at least forty-eight (48) hours prior to starting excavation work.

1.07 SPECIAL SCHEDULING REQUIREMENTS

A. Provide all materials, equipment, and personnel required to perform the work at the site prior to commencement of the work.
B. Permission to interrupt any activity or utility service must be requested in writing a minimum fifteen (15) calendar days prior to the desired date of interruption. The Owner will monitor work in restricted access areas.
C. The Owner's Security and Risk Management teams shall review the design documents at the schematic and design development phases.

1.08 PERMITS

A. The Contractor shall be responsible for obtaining the necessary permits for the work. Obtain permits from the Authorities Having Jurisdiction.
B. A Hot Work permit is required prior to performing hot work (i.e. welding, cutting, or other flame producing/spark producing). This permit can be obtained from the Owner's Project Manager.
C. Other special permissions and/or procedures may be required from other entities. Examples include but are not limited to environmental, dust containment, spill prevention, etc. Coordinate with the Owner's Project Manager prior to the start of work.

1.09 OTHER REQUIREMENTS

A. Specific Code requirements are to be adhered to when referring to kitchen facilities, restroom facilities, firefighting access and fire exiting/life safety aspects, swimming/wading pools and HVAC systems.
B. All new projects shall be reviewed by a third party for ADA compliance in, at a minimum, the design development phase. For larger projects, the third party shall review for compliance prior to one hundred percent (100%) contract documents. The Architect/Engineer shall incorporate time within their design schedule to accommodate these reviews.
C. All project participants including, but not limited to the architect, civil, structural, mechanical, plumbing, or electrical engineer, interior designer, landscape architect, energy modeler, sustainability consultant, LEED consultant and commissioning agent shall furnish to the Owner the following, no later than thirty (30) days after completion of the project and prior to the release of final payment:
    1. Complete REVIT file.
    2. One (1) set of one hundred percent (100%) Construction Documents (Drawings and Specifications) in PDF format.
    3. One (1) set of as built/record drawings, incorporating all addenda, ASI, RFI, and other construction change documentation in PDF format.
    4. All Operation and Maintenance (O&M) Manuals and a Materials Chart listing each material and product used in the building shall be submitted electronically to the Project Manager.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 11 00

01 15 00 – UNIVERSAL SPACE STANDARDS

7/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for universal space standards. Additional requirements may be included within specific agreements or other contracting documents.

B. Space standards are intended to ensure the City of Fort Collins creates and maintains functional and sustainable facilities which support its mission while maximizing efficiency. The space standard maximums apply to all new construction and any renovation where furniture is replaced but do not establish or imply minimum space entitlements. Exploring space efficiency to meet a department's requirements is encouraged.

1.03 DEFINITIONS

A. Field Crew One/Hybrid (1) = Employee that spends approximately fifty percent (50%) of time in the office and fifty percent (50%) of time in the field.

B. Field Crew Two/Remote (2) = Employee that checks in a few times a day but spends most of their time in the field.

C. Flex = Employee that spends less than three days per week in the office. Area and type of space provided shall be based on availability, function, and other considerations. Flex employees are not guaranteed assigned workspace.

D. Fulltime/Essential Onsite = Employee who is present in the office at least three (3) days per week or more.

E. Hoteling = A shared workspace that is unassigned and specifically designed for an employee to conduct typical office type work.

F. Parttime = Hourly employee with less than twenty-nine (29) hours per week and/or spends less than three (3) days per week in the office are not guaranteed assigned workspace.

G. Workstation = A workspace with/without cubicle type walls designed for an employee to conduct office type work.

1.04 STANDARDS

A. Square footage allowances are based primarily on employee designations within the City of Fort Collins organizational chart. Coordinate with the Operation Services PMPD Space Planner/Designer for individual designations.

B. Other types of spaces, including by not limited to common and collaboration spaces, shall be determined and approved on a per project basis.

C. Full-time employees or equivalents shall be considered for space in compliance with the square footages below:

DESCRIPTION*	**AREA (SF)**	**SPACE TYPE**
Service Area Director	One hundred eighty (180) square feet	Private Office

Director / Division Head / Department Head	One hundred forty (140) square feet	Private Office
Supervisor / Manager	Eighty (80) square feet	Workstation
Staff – Essential Onsite	Forty-eight (48) to sixty-four (64) square feet	Workstation
Field Crew 1 / Intern (Hybrid)	Thirty-two (32) square feet	Workstation or Hoteling
Field Crew 2 (Remote)	Sixteen (16) square feet	Hoteling
Flex	TBD	TBD

*Special requirements or requests will be evaluated on an individual basis. Requests should be submitted to Operation Services and will have final approval by the City Manager or Municipal Judge. All positions will fit within one of the above descriptions, even if a specific position is not listed.

1.05 OTHER REQUIREMENTS

A. All new construction for conference rooms or collaboration rooms will be provided with a glass front. Glass is intended to be transparent but may have bands of opaque frosting to provide visual separation. A maximum of two (2) six (6) inch bands of frosting that is spaced four (4) inches apart and centered at five (5) feet AFF is acceptable. Additional frosting or other visually limiting materials shall be approved by the City Manager on a case-by-case basis.
B. Include spaces for intentional collaboration or collision spaces. Plan for a minimum of one (1) space per every fifteen (15) employees that will be housed in the building.
C. All new construction will include at least one (1) quiet/nursing space per federal regulations. This space shall be identified as Wellness.
D. All new construction will include a janitor's closet that is at least one percent (1%) of the total square footage.
E. All new parking garage construction will include electric vehicle charging stations and bike lockers. The quantity will be provided by the Project Manager on a per project basis.
F. All new parking lots must include electric vehicle charging stations.
G. All new construction shall also ensure there is a separate Gender-Neutral Restroom for the building. Major building renovations that involve restroom modifications shall also ensure there is a separate Gender-Neutral Restroom for the building.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 15 00

01 25 13 – PRODUCT SUBSTITUTION PROCEDURE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for product substitution procedures. Additional requirements may be included within specific agreements or other contracting documents.

1.03 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer an advantage to Contractor or Owner.

1.04 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form provided in the Project Manual, or acceptable to the Owner.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product(s) or fabrication, or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include an annotated copy of the applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
      h. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time.
      i. Cost information, including a proposal of change, if any, in the Contract Sum.

j. Contractor’s certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
k. Contractor’s waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Owner and Architect/Engineer’s Action: If necessary, Owner and/or Architect/Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Owner and Architect/Engineer will notify Contractor of acceptance or rejection of proposed substitution within ten (10) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect/Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturer(s).

1.06 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.
B. Submittals: Substitutions shall be submitted during bidding. Substitutions requests during construction are not desirable and may not be considered.

1.07 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
   1. Conditions: Owner and Architect/Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results including compatibility with sustainability requirements.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals from authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
B. Substitutions for Convenience: Owner and Architect/Engineer will consider requests for substitution if deemed to be reasonable and received within sixty (60) days after commencement of work. Requests received after that time may be considered or rejected at discretion of Owner and Architect/Engineer.

1. Conditions: Architect/Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, the Architect/Engineer will return requests without action, except to record noncompliance with these requirements:
    a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    b. Requested substitution does not require extensive revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results including compatibility with sustainability requirements.
    d. Substitution request is fully documented and properly submitted.
    e. Requested substitution will not adversely affect Contractor's construction schedule.
    f. Requested substitution has received necessary approvals from authorities having jurisdiction.
    g. Requested substitution is compatible with other portions of the Work.
    h. Requested substitution has been coordinated with other portions of the Work.
    i. Requested substitution provides specified warranty.
    j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 25 13

01 26 00 – CONTRACT MODIFICATION PROCEDURES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for contract modifications. Additional requirements may be included within specific agreements or other contracting documents.

1.03 PROCEDURES AND REQUIREMENTS

A. All contract modifications and changes to Agreements must be approved by the Owner. Changes to Agreements shall be coordinated through the Owner's Purchasing department.

B. Contract modifications such as Pricing Requests, Change Orders, Construction Change Directives and similar shall be submitted in writing to the Owner for consideration.

C. Contractors are allowed a maximum of fifteen percent (15%) total overhead, profit and markup.

D. Modifications shall be approved and listed separately on the schedule of values for billing and payment.

E. All contract documents shall be processed using the Owner's forms. If you have questions reach out to the project manager.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 26 00

01 29 00 – APPLICATION FOR PAYMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for applications for payment. Additional requirements may be included within specific agreements or other contracting documents.

1.03 COST BREAKDOWN

A. The Contractor must furnish within thirty (30) days after the date of Notice To Proceed, and prior to the submission of its first partial pay request, a breakdown of its pay items which will be reviewed by the Owner's Project Manager.

1.04 PROCEDURES AND REQUIREMENTS

A. AIA Document G702 shall be required unless otherwise specified. Owners' summary cover page shall also be required to be completed, signed, and submitted with all applications for payment. The Owner's project manager will provide this cover page for use during the project.

B. Applications for payment shall be submitted to the Architect/Engineer for review for full compliance and then forwarded to the Owner for review, approval and submission for payment.

C. Contract modifications/change orders shall be approved and listed separately on the schedule of values for billing and payment.

D. Additional procedures and requirements may be incorporated through the Agreement between the Owner and the Contractor or Architect/Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 29 00

01 29 73 – SCHEDULE OF VALUES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for the schedule of values. Additional requirements may be included within specific agreements or other contracting documents. As a minimum, SOV breakout to be by CSI divisions with OH and profit separate.

1.03 PROCEDURES AND REQUIREMENTS

A. Payments will not be made until the schedule of values has been submitted to and accepted by the Owner's Project Manager. The Schedule of Values must be fully complete.

B. AIA form G703 shall be required.

C. Retainage held at five percent (5%) against each line item listed in the schedule of values shall be required unless otherwise specified. Retainage may be reduced during the project at the Owner's discretion.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 29 73

01 30 00 – ADMINISTRATIVE REQUIREMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for administrative requirements. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUPERINTENDENT QUALIFICATIONS

A. Provide project superintendent with a minimum of five (5) years of experience in construction on projects similar in size and complexity to the project.

B. Provide at least one (1) qualified superintendent or competent alternative, on the jobsite at all times during the performance of contract work. Unless the Owner gives approval for part-time supervision

C. The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project.

1.04 NON-COMPLIANCE ACTIONS

A. The project superintendent and any other construction staff are subject to removal by the Owner's Project Manager for non-compliance with requirements specified in the contract. Furthermore, the Owner's Project Manager may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

1.05 KICK-OFF MEETING

A. Immediately after award, coordinate with the Owner's Project Manager a time and place for a kick-off meeting. Every project shall have a kick-off meeting.

1.06 MEETINGS

A. Conduct regular meetings until project completion in coordination with the Owner's Project Manager. Meeting content discussed, shall at a minimum, include the following items:

1. Safety.
2. Quality Assurance/Quality Control.
3. Schedule.
4. Owner's Attention Items.
5. Contractor's Attention Items.
6. Designer's Attention Items.
7. First-in-place dates.
8. LEED and/or CX activities.

1.07 ELECTRONIC WEB-BASED PROJECT MANAGEMENT SOFTWARE

A. The Owner requires the use of an electronic, web-based, project management software program for maintaining project documents. The Owner shall host the program, and all design professionals and contractors are required to use the Owners program. The Owner's Project Manager will provide access to the web-based hosting website for use during the duration of the project.

1. Web-based software program: Procore.

2. Refer to the Procore Standard Operating Procedures in the appendix for additional information and requirements for both Architects/Engineers and Contractors.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 30 00

01 32 16 – PROGRESS SCHEDULES AND REPORTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for progress schedules and reports. Additional requirements may be included within specific agreements or other contracting documents.

1.03 PROJECT BASELINE SCHEDULE

A. Submit the baseline schedule within fifteen (15) calendar days after the contract award.

1.04 WEEKLY LOOK AHEAD SCHEDULE

A. Submit a look ahead schedule weekly until contract completion.

1.05 SCHEDULES

A. Contractor to prepare a CPM schedule prior to the first construction meeting.

B. Schedules and updates are due at each progress meeting.

C. Time extensions: Contractor to submit a Time Impact Analysis to indicate delay causes and justification for extension and any compensation for review.

1.06 WEATHER DELAYS

A. Weather: Must fall out of the extreme ranges in weather for a ten (10) year period.

B. The contractor shall submit a project schedule to the Owner showing all major tasks and milestones necessary to complete the project and show the relationship between the other tasks. The schedule shall show the critical path or the sequence of tasks that will take the longest to complete. The Owner shall review the submitted schedule and verify it meets the dates outlined in the contract and give the contractor written approval.

C. The date of beginning and the times for completion of the work are essential conditions of the Contract Documents and the work embraced shall be commenced on a date specified in the Notice to Proceed. The Contractor will proceed with the work at such rate of progress to ensure full completion within the contract time. It is expressly understood and agreed, by and between the Contractor and the Owner that the contract time for the completion of the work described in the contract are reasonable, taking into consideration the climatic and other factors prevailing in the locality of the work. Every effort shall be made by the Contractor to complete the project within the "Contract Time" shown in their proposal. The "Contract Time" anticipates a “Normal” weather and climate condition in and around the vicinity of the Project site during the times of year that the construction will be carried out. Extensions of time based upon weather conditions shall be granted only if the Contractor demonstrates clearly that such conditions were "abnormal or unusually severe," and could not be reasonably anticipated, and that such conditions adversely affected the Contractor’s work and thus required additional time to complete the project.

D. Procedures for the determination of time extensions for abnormal or unusually severe weather:

1. The schedule below defines the anticipated number of days lost to adverse weather for each month and is based upon National Oceanic and Atmospheric Administration (NOAA) or similar data for the geographic location of the project. For the Owner to award a time extension to the Contractor for abnormal or unusually severe weather, the following conditions must be satisfied:

a. The weather experienced at the project site during the contract period must be found to be abnormal weather, that is, more severe than the adverse weather anticipated for the project location during the contract period.
b. The abnormal weather must cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.
c. For an abnormal weather conditions delay to be considered, it must prevent work on Critical Path activities for fifty percent (50%) or more of the Contractor's scheduled work crew, for fifty percent (50%) or more of the day.
d. The weather must exceed the schedule of monthly adverse weather condition delays based on National Oceanic and Atmospheric Administration (NOAA) historical data for the Project location as stated below. This will constitute the baseline for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all-weather dependent activities.

2. Schedule for monthly anticipated adverse weather days based on a five (5) day work week:
   a. January: Five (5).
   b. February: Four (4).
   c. March: Three (3).
   d. April: Three (3).
   e. May: Four (4).
   f. June: Four (4).
   g. July: Five (5).
   h. August: Five (5).
   i. September: Three (3).
   j. October: Two (2).
   k. November: Three (3).
   l. December: Five (5).

E. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on their daily report, the occurrence of adverse and subsequent abnormal weather conditions and resultant impact to normally scheduled work. Actual abnormal weather condition delay days must prevent work on Critical Path activities for fifty percent (50%) or more of the Contractor's scheduled work crew, for fifty percent (50%) or more of the day. The number of abnormal weather condition delay days shall be days more than the actual adverse weather within the designated month and calculated chronologically from the first to the last day of each month and be recorded as full days. Unutilized adverse weather days do not carry-forward or accumulate. The Contractor is to notify the Owner at the end of each month in writing of the number of actual abnormal weather delays they incurred for the month. If the number of actual abnormal weather delay days exceeds the number of anticipated adverse weather delay days listed above, the Project manager will review the Contractor's documentation and give full consideration for equivalent fair-weather workdays and track the days on a log. If all four (4) conditions listed above are satisfied, the Owner will issue a change order to the Contractor for the additional days to the project schedule and the general conditions associated with these abnormal weather days.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTIONS (NOT USED)

END OF SECTION 01 32 16

01 33 00 – SUBMITTAL PROCEDURES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for submittals. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTAL INFORMATION

A. Submittals shall include all information necessary for full review. Items which are to be included are, but not limited to:
   1. Product data, shop drawings, technical data, color charts, reports, testing and Code information, certificates, manufacturer's instructions, O&M data, sample warranties, etc.
   2. Provide physical samples of any product requiring a color or finish selection. No electronic "samples" will be accepted.

B. The Owner's Project Manager may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in other sections of the projects contract documents.

C. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with the Contract Documents.

D. The Contractors quality control and/or project manager, hall check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified.

E. The Architect/Engineer of Record, if applicable, are to check and approve all items before submittal and stamp, sign and date indicating action taken. Propose deviations from the contract requirements are to be clearly identified.

1.04 SUBMISSION OF SUBMITTALS

A. Prepare a register of equipment and materials required for submission by the contract documents. Submit this register to the Owner's Project Manager within five (5) days after the Kick-Off Meeting date. This register may not be all-inclusive, and additional submittals may be required as requested by the Owner's Project Manager.

B. Provide submittals in electronic format, except for material and/or physical samples.

C. Submit and provide submittals requiring Owner's Project Manager approval before acquiring the material or equipment covered thereby. The Owner will not be responsible for any cost or project schedule delays if materials or equipment are obtained without Owner approval.

D. The Contractor shall track all submittals and is responsible for managing the same.

E. Samples of various materials and equipment may be taken by the Owner's Project Manager for testing. Samples failing to meet contract requirements will void previous approvals. Contractor shall replace such materials or equipment to meet contract requirements.

1.05 VARIATIONS

A. When preparing a variation, clearly mark the submittal and include documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to the Owner. If lower cost is a benefit, also include an estimate of the cost savings.

B. Failure to identify variations may result in rejection and removal of such work at the Contractor's expense.

1.06 DISAPPROVED SBMITTALS

A. Make corrections required. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract documents, the Contractor shall give notice to the Owner's Project Manager.

B. The Contractor is responsible for the dimensions, design connection details, and the construction of the work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 33 00

01 35 10 – CONSTRUCTION RECYCLING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for construction recycling. Additional requirements may be included within specific agreements or other contracting documents.

1.03 GENERAL

A. The City of Fort Collins Municipal Code and Fort Collins Building Code requires all new construction, remodels, and additions over two thousand-five hundred (2,500) gross square feet, and all deconstruction projects over one thousand (1,000) gross square feet to recycle specific materials. Refer to those requirements for permit and reporting requirements.

B. The Owner's Project Manager may require projects which are smaller than the required square footages, to also recycle materials. The Owner's Project Manager will coordinate with the Contractor for specific requirements.

C. Projects utilizing a third (3rd) party sustainable certification program (ex., LEED) may require additional documentation and diversion requirements. Refer to the requirements necessary for those projects.

1.04 DIVERSION

A. A minimum seventy-five percent (75%) diversion rate of materials is required.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 35 10

01 35 23 – SAFETY / ENVIRONMENTAL REQUIRMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for safety and environmental requirements. Additional requirements may be included within specific agreements or other contracting documents.

1.03 GENERAL

A. In addition to the requirements included in this section, comply with the most recent addition of all federal, state and local laws, ordinances, criteria, rules and regulations, and standards.

B. All projects must include a discussion with the Owner's Safety, Security, and Risk Management staff as coordinated with the Owner's Project Manager to determine special needs, if applicable.

C. Contractors are responsible for all acts and omissions of all subcontractors.

D. Architects/Engineers are responsible for all acts and omissions of all their staff, teaming partners, and subcontractors.

E. All contractors, subcontractors, and visitors must adhere to all rules, regulations and requirements, including but not limited to OSHA. Failure to do so will result in the removal from the jobsite.

F. Permanent fall projection must be provided at any height above six feet off a horizontal surface. This includes areas like catwalks, mezzanines, orchestra pit, surge pit, etc., above or below an area. Protection may include, but is not limited to, parapet wall, roof anchor, or applicable method as approved by the Owner.

G. All buildings will include an Arc Flash study in accordance with NFPA 70E.

H. Contractors are required to complete a Criminal Record Check on all employees.

1.04 SAFETY MEETINGS

A. Conduct safety meetings to review past activities, plan for new or changed operations, and safe work procedures for anticipated hazards.

1.05 PROHIBITED MATERIALS

A. The use of the following products and/or materials is prohibited on all projects:
   1. Products and/or materials containing asbestos.
   2. Products and/or materials containing urea formaldehyde.
   3. Products and/or materials containing polychlorinated biphenyls.
   4. Solder or flux containing more than 0.2 percent lead and domestic water pipe or pipe fittings containing more than eight percent (8%) lead.
   5. Paint and/or coatings containing lead.
   6. HBCD (Hexabromocyclododecane) – Commonly used in rigid insulation material as a fire-retardant.

1.06 PROHIBITED BUILDING AND/OR MATERIAL SYSTEMS

A. The use of the following building and/or material systems is prohibited on all projects:
   1. Exterior Insulation Finish Systems (E.I.F.S).
   2. PEX Piping.
   3. Flexible electrical conduit.

1.07 LEAD PAINT/ASBESTOS CONTAINING MATERIALS

A. Obtain approval from the Owner prior to beginning any work on existing facilities. The Owner's Project Manager shall investigate and coordinate any additional testing of materials with the Owner's Environmental Department. Confirmation of the presence of asbestos containing materials is required prior to any construction activities.
B. Lead-Based Paint in Alteration or Deconstruction Projects: When alteration or demolition requires sanding, burning, welding or scraping painted surfaces, test the paint for lead content. If lead is found, implement the controls required by OSHA in 29 CFR 1926.62.
C. Discovery of Potentially Hazardous Materials: If potentially hazardous materials are found during construction activities, the Contractor shall immediately stop all work and notify the Owner.

1.08 OTHER

A. Recycled Materials. Architects/Engineers should use recycled materials to the maximum extent practical and economically viable within the project requirements.
B. Prior to occupancy, run a purge cycle of one hundred percent (100%) outside air for several days.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 35 32

01 35 63 – SUSTAINABILITY CERTIFICATION PROJECT REQUIREMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REFERENCES

A. Publications listed below form a part of this section to the extent referenced:
   1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
   2. U.S. Department of Energy (DOE).
   3. U.S. Green Building Council (USGBC), LEED Building Design and Construction.

1.03 SUMMARY

A. Section includes administrative and procedural requirements for sustainability documentation and certification. Additional requirements may be included within specific agreements or other contracting documents.

1.04 GENERAL

A. Owner recognizes there are several existing and emerging green building standards that are applicable to government facilities. Our philosophy is to keep apprised of relevant standards and to determine which will be employed on a project-by-project basis. However, typical requirements are that all projects greater than five thousand (5,000) square feet will meet LEED Gold Certification based on the current rating system. The design of these buildings shall incorporate as many of green building principles (energy & water conservation, material selection, site location, etc.) as feasible to reduce building operating and maintenance costs along with minimizing environmental impacts. The minimum goal is fifteen (15) points; set target points with project manager and City of Fort Collins Energy Manager.

B. The costs and benefits will play into decisions about LEED on an individual project basis. To maintain fiscal integrity of the project – if the payback from the additional cost of meeting Gold Certification over that of meeting Silver Certification is greater than ten (10) years OR if the payback from the additional cost of meeting Gold Certification when compared to the local market cost for a similar building type is greater than ten (10) years, then the Owner's staff will recommend which level of LEED certification is appropriate for that particular project.

1.05 DESIGN AIDS AND RESOURCES

A. The following are design aids for use in products:
   1. LEED™.
   2. Green Globes.
   3. City of Fort Collins Green Building Code.
   4. City of Fort Collins Sustainable Purchasing Guidelines.
   5. City of Fort Collins Integrated Design Program.
   6. AIA Integrated Project Delivery.
   7. Zero Energy Performance Index (zEPI).
   8. International Well Building Institute (WELL).
   9. If there are questions regarding the viability of additional design aids, approval before use is required by the Director of Operation Services or assigned Project Manager.

B. The following resources are potentially valuable design aids for projects:
   1. Sustainable site planning and landscape design.
   2. Use of renewable energy sources.

3. High quality and energy efficient lighting.
4. Energy efficient building shell.
5. Energy efficient HVAC systems.
6. Indoor environmental quality, including environmentally preferable building materials, indoor air quality, acoustics and total moisture control.
7. Water conservation.
8. Security.
9. Kitchen operations.
10. Recycling and waste management.
11. Construction waste reduction and recycling.
12. Commissioning.
13. Maintainability.

1.06 NET ZERO

A. The Owner is targeting Net Zero Buildings for the future. By the **year 2030** (two thousand-thirty) all new construction of city buildings will be Net Zero. The amount of energy a Net Zero Building uses on an annual basis is roughly equal to the amount of renewable energy created on the site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 35 63

01 35 65 – GREEN BUILDING GUIDELINES

(FOR USE WITH NON-LEED CERTIFIED PROJECTS)

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 REFERENCES

A. Publications listed below form a part of this section to the extent referenced:
   1. Code of Federal Regulations (CFR).
   2. Forest Stewardship Council (FSC).
   3. U.S. Green Building Council (USGBC), LEED Building Design and Construction.

1.03 SUMMARY

A. Section includes administrative and procedural requirements for sustainability requirements for non-LEED certified projects. Additional requirements may be included within specific agreements or other contracting documents.

1.04 REQUIREMENTS

A. Contractor shall follow general sustainable design and construction guidelines and procedures for projects where the LEED Green Building Rating System certification will not be pursued.

B. Submittals shall provide information related to the sustainability design criteria required by individual sections of these Standards.

C. Requirements specified elsewhere:
   1. Section 01 61 00 – Common Product Requirements.

1.05 DEFINITIONS

A. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC1.2, “Principles and Criteria”. Certificates shall include evidence that the mill is certified for chain-of-custody by an FSC-accredited certification body.

B. Regionally Manufactured Materials: Materials that are manufactured or assembled within a radius of five hundred (500) miles from the project location.

C. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of five hundred (500) miles from the project site.

D. Recycled Content: Percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, whether during the manufacturing process (pre-industrial) or after consumer use (post-consumer).

E. Certified Wood: Wood-based materials and products which are certified in accordance with the Forest Stewardship Council (FSC) Principles and Criteria for sustainably harvested and processed wood building components.

1.06 SUBMITTALS

A. General: Refer to specific sections of these Standards. Contractor tracking of sustainability submittals is not required but highly encouraged.

PART 2 – PRODUCTS

2.01 RECYCLED CONTENT OF MATERIALS

A. General: Provide documentation for building materials with recycled content of post-consumer recycled content and post-industrial recycled content.
   1. Recycled content shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims", 16 CFR 260.7 (e).

2.02 REGIONAL MATERIALS

A. Project Goal: Provide documentation to support a minimum of twenty percent (20%) of building materials (by cost) that are regionally manufactured or assembled materials within five hundred (500) miles of the project site. LEED now requires some materials to be within 100 miles.
   1. Of the regionally manufactured materials specified above, provide at least fifty percent (50%) (by cost) that are regionally extracted, harvested, or recovered materials.

2.03 LOW-EMITTING MATERIALS

A. For interior applications, use adhesives and sealants that comply with the following limits for VOC content:
   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 and Carpet Pad Adhesives: 50 g/L
   7. VCT, Asphalt Tile, and Cove Base Adhesives: 50 g/L
   8. Gypsum Wallboard and Panel Adhesives: 50 g/L
   9. Rubber Floor Adhesives: 60 g/L
   10. Ceramic Tile Adhesives: 65 g/L
   11. Multi-purpose Construction Adhesives: 70 g/L
   12. Fiberglass Adhesives: 80 g/L
   13. Structural Glazing Adhesives: 100 g/L
   14. Wood Flooring Adhesives: 100 g/L
   15. Contact Adhesives: 250 g/L
   16. Top and Trim Adhesive or other Special Purpose Contact Adhesives: 250 g/L
   17. Plastic Cement Welding Compounds: 350 g/L
   18. ABS Welding Compounds: 400 g/L
   19. CPVC Welding Compounds: 490 g/L
   20. PVC Welding Compounds: 510 g/L
   21. Adhesive Primer for Plastic: 650 g/L
   22. Architectural Sealants: 250 g/L
   23. Other Sealants: 420 g/L
   24. Sealant Primers for Non-porous Substrates: 250 g/L
   25. Sealant Primers for Porous Substrates: 775 g/L
B. For interior applications, use paints and coatings that comply with the following limits for VOC content and the following chemical restrictions per Green Seal Standard GS-11:
   1. Flat Paints and Coatings: VOC not more than 50 g/L
   2. Non-flat Paints and Coatings: VOC not more than 150 g/L
   3. Anti-Corrosive Coatings: VOC not more than 250 g/L
   4. Varnishes and Sanding Sealers: VOC not more than 350 g/L
   5. Stains: VOC not more than 250 g/L
   6. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L
   7. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L
   8. Floor Coatings: VOC not more than 100 g/L

9. Waterproofing Sealers: VOC not more than 250 g/L
10. Waterproofing Concrete/Masonry Sealers: VOC not more than 400 g/L
11. Sanding Sealers: VOC not more than 275 g/L
12. All other Sealers: VOC not more than 200 g/L
13. Clear Shellac: VOC not more than 730 g/L
14. Pigmented Shellac: VOC not more than 550 g/L
15. Aromatic Compounds: Paints and coatings shall not contain more than one percent (1 percent) by weight total aromatic compounds.
16. Restricted Components: Paints and coatings shall not contain acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ehylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, or vinyl chloride.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 35 65

01 42 16 – DEFINITIONS

7/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes definitions. Other definitions are included in individual sections. Additional requirements may be included within specific agreements or other contracting documents.

1.03 DEFINITIONS

A. City of Fort Collins = Owner. See definition for Owner.
B. Furnish: To supply, deliver, unload, and inspect for damage.
C. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
D. MIL(s) = A unit of length equal to one thousandth of an inch.
E. Owner: Operation Services Project Management, Planning, and Design team shall manage and/or be responsible for decisions relating to all City of Fort Collins building projects whether new or renovation including furniture, painting, and similar finish installations. City Manager or City Attorney may also be referenced in specific sections due to approval requirements.
F. Product: Material, machinery, components, equipment, fixtures and systems forming the work result. Products may be new, never used, or re-used materials or equipment.
G. Provide: To furnish and install.
H. Restroom: Indicated dedicated space that includes a toilet, urinal, sink. May contain a shower.
I. Supply: Same as Furnish.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 42 16

01 45 00 – QUALITY CONTROL

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for quality control. Additional requirements may be included within specific agreements or other contracting documents.

1.03 GENERAL REQUIREMENTS

A. Establish and maintain an effective quality control program that covers all design and construction operations. Establish and maintain a quality control and quality assurance program. The program consists of a plan, meetings, and coordination.
   1. Prior to beginning the project, conduct a pre-design and/or pre-construction meeting to discuss the quality control plan. During the meeting, a mutual understanding of the details must be developed, including forms for recording operations, activities, testing, and administration.

B. Contractor to maintain daily reports, take regular photographs, maintain a project survey.

C. Contractor to GPS underground utilities.

D. Remodels: Contractor to take extensive before/after video or pictures for future reference/ claims against either party for damages.

E. Quality Assurance/Quality Control manual will be provided by the project manager to the contractor.

F. New Construction projects shall construct a separate mock up wall that will be used to work out tie-in of different materials, flashing details, rain screen, air barrier, wall/roof connections.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 45 00

01 61 00 – COMMON PRODUCT REQUIREMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for common products. Additional requirements may be included within specific agreements or other contracting documents.

1.03 RELATED SECTIONS
- A. Section 01 35 66 – Green Building Guidelines.

1.04 REGULATORY REQUIREMENTS
- A. Observe environmental precautions based on conditions.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Preference will be given to manufacturers who demonstrate sustainability practices in their own operations.
- B. Preference will be given to manufacturers that take back excess and used material for recycling/reuse. Note that unless stated for a specific product, three percent (3%) of materials must be turned over to the Owner for attic stock.
- C. All cleaning and maintenance instruction to be included in operations and maintenance chart (see section 01 11 00 – Summary of Work).

2.02 PRODUCTS
- A. Source materials and products regionally whenever possible. Submit documentation of manufacturing locations and origins of materials for products manufactured and/or sourced from within five hundred (500) miles of the building site. Local materials have less energy cost and air pollution associated with their transportation and can help sustain a local economy.
- B. Use recycled and/or rapidly renewable materials whenever possible. Submit invoices and listings of recycled and/or rapidly renewable materials that are used.
  1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
  2. Select products with the highest recycled or rapidly renewable content that is readily available.
- C. Use salvaged and recovered products where feasible. Submit documentation showing the origins of any salvaged products.
- D. Equipment: All purchased appliances/equipment must be Energy Star certified.
- E. All products installed in an interior location or location that can off-gas to the interior of the building shall comply with the following VOC limits:
  1. Plywood Adhesive: Water based contact cement with VOC content not to exceed ten (10) grams per liter.
  2. Total VOC for Upholstered Assembly: Not greater than 0.5 mg/m2/hr.
  3. Formaldehyde Emission for Fabric: Not greater than 0.05 mg/m2/hr.
  4. Formaldehyde Emission for Adhesive: Not greater than 0.05 mg/m2/hr.
  5. Phenylcydohexene Emission: Not greater than 0.05 mg/m2/hr.

6. Styrene Emission: Not greater than 0.05 mg/m2/hr.
7. 2 Ethyl - 1 Hexanol Emission: Not greater than 3.00 mg/m2/hr.
8. General Adhesives: Water based adhesives with VOC content not to exceed two hundred fifty (250) grams per liter.
9. Do no provide adhesives or accessories for wood flooring installation with a VOC content greater than one hundred fifty (150) grams per liter (excluding finishing materials).
10. Finishing Material Adhesive: Water based adhesives with VOC content not to exceed three hundred fifty (350) grams per liter.

F. Metals:
   1. The following recycled content standards must be met for all metals applications, unless otherwise noted:
      a. Steel Recycled Content: Minimum twenty-three percent (23%) post-consumer recycled content, or minimum seven percent (7%) pre-consumer recycled content at contractor's option.
      b. Aluminum Recycled Content: Minimum five percent (5%) post-consumer recycled content, or minimum twenty percent (20%) pre-consumer recycled content at contractor's option.
      c. Copper Recycled Content: Minimum five percent (5%) post-consumer recycled content, or minimum twenty percent (20%) pre-consumer recycled content at contractor's option.

G. Wood:
   1. All wood-based materials and products shall be certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria. Submit FSC Chain of Custody Certification Numbers for all wood-based materials and products used in the project.
   2. Source wood from beetle damaged forests when possible.
   3. All composite wood should not contain urea formaldehyde resin binders. Provide appropriate documentation.
   4. The following product alternatives should be applied in wood sheathing projects, and the respective standards met, whenever feasible:
      a. Bio-based content for Engineered Wood Products:
         i. Interior Panels: Engineered products designed specifically for interior applications and providing a surface that is impact-, scratch-, and wear-resistant and that does not absorb or retain moisture. Provide minimum fifty-five percent (55%) bio-based content.
         ii. Structural Interior Panels: Engineered products designed for use in structural construction applications, including cabinetry, casework, paneling, and decorative panels. Provide minimum eighty-nine percent (89%) bio-based content.
         iii. Structural Wall Panels: Engineered products designed for use in structural walls, curtain walls, floors and flat roofs in commercial buildings. Provide minimum ninety-four percent (94%) bio-based content.
      b. Fiberboard recycled content:
         i. Structural: Minimum eighty percent (80%) recycled content.
         ii. Non-Structural: Minimum one hundred percent (100%) post-consumer recycled content.
      c. Cellulose Honeycomb Panels: One hundred percent (100%) post-consumer recycled content.

H. Plastic:
   1. Plastic Lumber:

a. The following standards must be met for all plastic lumber applications.
b. Recycled content:
i. HDPE: Minimum twenty-five percent (25%) post-consumer recycled content.
ii. Mixed plastics/cellulose: Minimum fifty percent (50%) post-consumer recycled content.
iii. HDPE/fiberglass: Minimum seventy-five percent (75%) post-consumer recycled content.
iv. Other/fiberglass: Minimum seventy-five percent (75%) post-consumer recycled content.
c. Bio-based content:
i. Engineered products suitable for non-structural outdoor needs such as exterior signs, trash can holders, and dimensional letters. Provide a minimum of twenty-three percent (23%) bio-based content.

2. Compostable Plastic: Plastic fabrications intended for temporary use, including but not limited to landscaping identification tags, tie and stakes, shall be fabricated from compostable plastic. Coordinate with work of related Sections.

I. Fabric:
1. Preference given for materials with the highest bio-based/rapidly renewable content feasible.
2. Preference given for materials with the highest recycled content feasible, with a target of one hundred percent (100%) post-consumer recycled (PET) content.
3. Chemical treatments, including wrinkle-resistant treatment, fire-resistant treatment, and moth treatment, are not permitted.

J. Paints, coatings, finishes, adhesives, solvents, cleaners, lubricants, and other fluids:
1. The following characteristics are required:
a. Water based, water soluble, or water cleanup.
b. Non-flammable.
c. Biodegradable.
d. Low VOC content.
2. Use inert compounds with natural binders where feasible.

K. Fixtures:
1. Use only one hundred percent (100%) re-melted steel fasteners.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Where feasible for products, use bolted connections to allow for disassembly and reuse.

3.02 ATTIC STOCK

A. Provide a minimum of three percent (3%) or one (1) box, whichever is greater, for products unless otherwise listed below:
1. Brick & Mortar: Two percent (2%) with one (1) pallet minimum and five (5) gallons of mortar mix.
2. Pavers: Two percent (2%) with one-half (½) pallet minimum.
3. Carpet of each type: Five percent (5%).
4. Wood Flooring: Two percent (2%).
5. Tile: Ten percent (10%) with ten full pieces minimum, and one bag of grout.
6. Wall Base: Three percent (3%) or one (1) box minimum.
7. Wood Trim: Eight (8) linear feet of each type.

8. Paint for each color: One (1) gallon of each color.
9. Ceiling Tiles: Two percent (2%) or a minimum of one (1) box.
10. Wall Fabric: One (1) roll.
11. Sprinkler heads: Two (2) of each type.
12. Filters: Two (2) sets of filters for filter separator, two (2) sets of filter bags, and two (2) sets of belts for each fan.
13. VCT: Two percent (2%) or a minimum of one (1) box of each color.

END OF SECTION 01 61 00

01 66 00 – NON-UTILIZATION OF ASBESTOS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes information related to asbestos and asbestos containing material. Additional requirements may be included within specific agreements or other contracting documents.

1.03 GENERAL REQUIREMENTS

A. Asbestos and asbestos containing materials shall not be used on any Owner projects. Contractor and/or Architect/Engineer must certify all newly installed materials are free of asbestos and/or asbestos containing materials.

B. If suspected asbestos and/or asbestos containing materials are encountered, the Owner and Owner's Environmental Services are to be notified immediately.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 CERTIFICATION FORM

A. Contractor and/or Architect/Engineer must complete the certification form prior to the final closeout of any work or project.

B. If Architect/Engineer is required to sign the form, the Architect/Engineer must also provide their appropriate Colorado professional seal, date, and signature.

END OF SECTION 01 66 00

01 74 00 – CLEANING AND WASTE MANAGEMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes information related to cleaning and waste management. Additional requirements may be included within specific agreements or other contracting documents.

1.03 APPLICATION
- A. The provisions and requirements of this section shall apply to all Owner projects.
- B. For smaller projects, coordinate with the Owner for requirements applicable to the work being completed.
- C. Obtain written approval from the Owner for deviations, exemptions and/or special circumstances which makes the application of this section impractical.

1.04 DEFINITIONS
- A. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.
- B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, including construction, remodeling, repair, and demolition operations.
- C. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.
  1. Rubbish: Includes both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, tin cans, and bones.
  2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.
- D. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- E. Sanitary Waste:
  1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
  2. Sewage: Domestic sanitary sewage.

1.05 WASTE MANAGEMENT
- A. Waste management goals: A minimum of seventy-five percent (75%) of total project waste shall be diverted from landfill.
- B. Documentation: Provide documentation to show evidence that waste management, recycling, and reused of recyclable and reusable materials have been maximized.

1.06 STORMWATER POLLUTION PREVENTION
- A. Refer to the storm water procedures guide that will be provided by the Owner. A copy of this guide must be kept on-site at all times for reference.

1.07 SUBMITTALS
- A. Site Waste Management Program: Prior to commencement of Work, schedule and conduct meeting with Owner and Architect/Engineer to discuss proposed Site Waste Management Program.
  1. Develop mutual understanding relative to details of recycling, and rebate programs.

2. Prepare and submit a written and graphic Site Waste Management Program including, but not limited to, the following:
    a. Indicate procedures to be implemented.
    b. Estimate total Project waste to be generated and estimated cost of disposing of Project waste in landfills.
    c. Estimate total cubic yards of following waste categories to be diverted from landfill.
        i. Clean dimensional wood, palette wood.
        ii. Plywood, oriented strand board, and medium density fiberboard.
        iii. Cardboard, paper, packaging.
        iv. Other items as directed by Owner and Architect.
    d. Estimate amounts of following waste categories in appropriate units (weight, feet, square yards, gallons).
        i. Metals.
        ii. Gypsum board.
        iii. Carpet.
        iv. Paint.
        v. Other items as directed by Owner and Architect/Engineer.
    e. Submit permit or license and location of waste disposal areas.
    f. Submit procedures for recycling/re-use program.
    g. Submit procedures for rebate programs.
    h. Revise and resubmit Site Waste Management Program.
        i. Review of Contractor's Site Waste Management Program will not relieve Contractor of responsibility for control of pollutants and other environmental protection measures.
3. Submit summary of solid waste generated by Project with each application for progress payment. Include the following information:
    a. Name of firm accepting the recovered materials or waste materials.
    b. Specify type of facility (e.g. recycler, processor, Class III landfill, MRF).
    c. Location of the facility.
    d. Type of materials.
    e. Net weights of each type of recovered material.
    f. Date of delivery.
    g. Value of the materials or tipping fee paid.
4. Prepare an electronic submission with rebate information and product documentation as required for rebate programs; submit with final closeout submittals.

B. Recycling Program
1. Recycling: Implement recycling program that includes separate collection of waste materials of following types as applicable to Project:
    a. Asphalt.
    b. Land clearing debris.
    c. Soil.
    d. Trees and shrubs.
    e. Concrete and concrete blocks.
    f. Brick and masonry materials.
    g. Untreated lumber.
    h. Clean dimensional wood and palette wood.
    i. Plywood, oriented strand board, and medium density fiberboard.
    j. Paper – bond.

k. Paper (e.g. newsprint).
l. Cardboard and paper packaging materials.
m. Plastics.
n. Rigid foam.
o. Insulation.
p. Ferrous metal.
q. Non-ferrous metals (e.g. copper, aluminum, etc.).
r. Glass.
s. Gypsum board (unpainted).
t. Carpet and pad.
u. Paint.
v. Beverage containers.
w. Plumbing fixtures.
x. Electrical fixtures and wires.
y. Others as appropriate.

2. Separation of Waste: Contractor and subcontractors are both required to separate recyclable materials into bins and to arrange for delivery of recyclable materials to recycling facility. Clearly label all recycling containers and list acceptable and unacceptable materials.
3. Handling: Keep materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
   a. Clean materials that are contaminated prior to placing in collection containers.
   b. Arrange for collection by or delivery to appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.
4. Participate in Re-Use Programs: Rebates, tax credits, and other savings obtained for recycled or re-used materials shall accrue to Contractor.
   a. Delivery, Storage, and Handling.
   b. Regulatory Requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 74 00

01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes information related to sustainable design requirements for Owner projects. Additional requirements may be included within specific agreements or other contracting documents.

B. The minimum threshold for sustainable projects is to achieve a USGBC LEED Gold rating (if project is over 5000 sq ft). Deviation requests must be submitted to the Owner and approved by the City of Fort Collins Director of Operation Services.

1.03 GENERAL REQUIREMENTS

A. All Owner construction projects should include:

1. Maintenance and Management: Maintenance and management need to be considered at the design stage, as the selection of material and finishes will impact on the types of maintenance requirements that can be sustained over time. This is related to the neighborhood's sense of 'pride of place' and territorial reinforcement. The more dilapidated an area, the more likely it is to attract unwanted activities. The maintenance and 'image' of an area can have a major impact on whether it will become targeted.

B. Acoustics: Appropriate acoustical design is extremely important in all types of government facilities. The design consultant shall provide acoustical separation or isolate noise-generating activities, areas, and equipment. The spaces shall be designed with appropriate acoustical separations, acoustical absorption and reverberation time for all intended activities and the various acoustical volumes. As a minimum standard, the design of conference rooms, offices, and other core spaces per the current version of LEED. Special attention shall be paid to providing vibration control and sound isolation for mechanical and electrical equipment, particularly mechanical rooftop units placed above occupied spaces.

C. Integrated Project Design and Whole Building Design:

1. Owner believes the key to achieving a sustainable facility is to employ an integrated design approach. This has been misinterpreted by some to mean putting together a good team that works well together.
2. Integrated design extends beyond this meaning in two ways:
   a. Holistic, rather than systems-based design.
   b. Collaboration that extends beyond the design team and beyond traditional perspectives. New City projects and major renovations shall go through the Utilities IDAP program. To fully incorporate the Integrated Design Process the following groups should be included at initial partnering meetings: Owner, Architect, Engineers, Contractor, Sustainability Consultant, Energy Modeling Consultant, Commissioning Consultant, and any other applicable roles that will be utilized throughout the construction process.
3. The design process largely analyzed individual components and subsystems of each building, optimizing them separately. Whole building design not only looks at how materials, systems, and products of a building connect and overlap, but also considers how the building and its systems can be integrated with supporting systems on its site and in its community. A

successful whole building design is a solution that is greater than the sum of its parts. The fundamental challenge of whole building design is to understand that all building systems are interdependent.

D. Building Performance goal values will be set on a case-by-case basis, but may include the following:
   1. ENERGY STAR™ rating.
   2. LEEDTM gold rating or better.
   3. Energy use (e.g., kBtu/ft^2/yr).
   4. Electric demand limits for peak periods.
   5. Water use and uniformity.
   6. Construction recycling diversion rate.
   7. Lighting load and electric plug load densities.
   8. Lighting and heating, ventilation, and air conditioning (HVAC) occupancy schedules.
   9. HVAC occupied/unoccupied set points.

E. Each project shall maximize energy efficiency and target as many energy and atmosphere credits as possible.

1.04 BUILDING INFORMATION MODELING

A. Building Information Modeling (BIM) shall be used for all systems, including Architectural, Structural, Mechanical, and Electrical to facilitate clash detection early in the design process.

B. Level: The level of development (LOD) shall be a minimum Level 300 or as otherwise established by the Owner.

1.05 ENERGY MODELING

A. Definitions:
   1. Energy Modeling: Provide a structure for energy modeling for Owner's building design projects.
   2. Modeling: Refers to computer building simulation using hourly weather data.

B. General:
   1. The energy modeling shall be brought into the design team during conceptual design or at no later than the beginning of the schematic design phase.
   2. The modeler shall work closely with the rest of the design team. Through an integrated design process, the modeler should be kept aware of key design element changes affecting the model.
   3. Energy goals shall be determined for the project.
   4. The modeler will be hired by the Owner and modeling activities and reporting will be coordinated through the Owner in conjunction with the design team. The modeler must provide documentation that they are a certified ASHRAE Building Energy Modeling Professional.

C. Minimum Requirements:
   1. Programming/Pre-design/Conceptual Design
      a. Objectives:
         i. Set energy goals;
         ii. Establish a reference base case building model;
         iii. Evaluate passive elements such as shape, orientation, and fenestration/daylighting.
      b. General: The model will have to be simple enough that the modeling budget is not significantly impacted and detailed enough that some basic design questions can be addressed. In some cases, it may be useful to use the model to help set energy goals (e.g. for unique building types).
   2. Schematic Design

a. Objectives:
    i. Optimize passive building elements, such as shape, orientation, envelope design (roof, wall, windows), insulation type and levels, mass, and daylighting schemes;
    ii. Identify Energy Efficiency Measures (EEMs) with regards to HVAC, lighting and other building systems;
    iii. Select the most promising EEMs based on life-cycle cost. Packages of complimentary EEMs should be presented. Utility and other incentives should be evaluated in this assessment. Some measures that might be "thrown out" on initial analysis might make more sense when incentives are included.
    iv. Re-evaluate energy goals.
b. General:
    i. As the building design becomes more refined, it will be necessary to update the model. Prospective EEMs should be compared against the baseline individually and in combination to achieve the project energy goal.
    ii. The modeler will need to work closely with mechanical and electrical designers. The modeler will need to raise "red flags" when they see critical design issues emerging, especially for which quick decisions will need to be made.
c. Reporting Requirements:
    i. Provide one report at fifty percent (50%) SD and one hundred percent (100%) SD. Required reporting elements are given in Appendix B.
    ii. In addition to the two (2) formal SD reports, it is expected that several "mini-studies" be performed prior to fifty percent (50%) and one hundred percent (100%) SD reports. The purpose of these mini-studies is to provide quick feedback to the design team on critical path items. The subjects of these mini-studies could be high-profile, critical-path EEMs for which decisions must be made quickly or evaluations of more subtle EEMs as individual items or in groups. The intent is to do enough modeling so that a go, no-go decision can be made on a particular design element to keep the design process moving.

3. Design Development
    a. Objectives:
        i. Refine definition and savings results from EEM selected in SD;
        ii. Provide the Owner with adequate information to select the final group of EEMs for the project;
        iii. Provide a comprehensive energy report.
    b. Reporting Requirements:
        i. Provide two formal reports, one at fifty percent (50%) DD and one at one hundred percent (100%) DD. Required reporting elements are given in Appendix B.
4. Construction Documents
    a. Objectives:
        i. Clarify unanswered questions about the design/systems and to document the final design for use with LEED certification, incentives, and/or post-occupancy energy management.
        ii. Inform the sizing of the building transformer(s) to prevent oversizing.
    b. Reporting Requirements:
        i. Provide two formal reports, one at fifty percent (50%) CD and one at one hundred percent (100%) CD. Required reporting elements are given in Appendix B.
5. Post Occupancy
    a. General:

i. There may be a request to adjust the model to reflect as-built conditions. The model may also be used in the Measurement and Verification (M&V) process to access whether the actual performance reflects modeled performance. Where there is a mismatch, it will be necessary to determine if it is due to an error in the modeling or something with the system.

1.06 MODELING REQUIREMENTS

A. Tool: ASHRAE 140 certified.

B. Inputs:

1. Weather Input File: Fort Collins TMY3/.
2. Utility Rates:
   a. Electric: Fort Collins Utilities Rates. Refer to the City of Fort Collins Utilities Website. See below required modeling details for electric rates.
   b. Gas: Current Xcel Energy gas rates. Check with the City Energy Manager for the appropriate rate.
   c. Assume five percent (5%) utility annual increase.
3. Setpoints
   a. For building setpoints, use seventy (70) degrees Fahrenheit for the occupied heating and seventy-five (75) degrees Fahrenheit for the occupied cooling. Unoccupied setback in heating mode is sixty-five (65) degrees and off for unoccupied cooling. The occupied/unoccupied times will be defined by the design team in conjunction with the Owner.
4. Coincident Peak
   a. Use the load on the peak day for each month at the following hours to determine the Coincident Peak value.

Month	Hour Ending
Jan	7:00 PM
Feb	7:00 PM
Mar	7:00 PM
Apr	9:00 PM
May	5:00 PM
Jun	5:00 PM
Jul	5:00 PM
Aug	5:00 PM
Sep	5:00 PM
Oct	7:00 PM
Nov	7:00 PM
Dec	7:00 PM

   b. For explanations of Facility and Coincident Peaks, refer to the City of Fort Collins Utilities website.

1.07 REPORTING REQUIREMENTS

A. General

1. This information is required for fifty percent (50%) and one hundred percent (100%) SD, fifty percent (50%) and one hundred percent (100%) DD, and fifty percent (50%) and one hundred percent (100%) CD reports unless otherwise noted in the appendix. Report requirements may vary somewhat by stage, based on the modeling requirements of each stage.

2. Life cycle cost assessment(s) should be presented at key junctures in decision making. The assessments should use a twenty (20) year life cycle, with a five percent (5%) discount rate and three percent (3%) annual utility escalation rate. The Xcel Energy "Energy At-Risk Financial Tool" is the preferred method for presenting life cycle cost.
3. Required Tables and Graphs: The following table is to be used in all milestone reports. In early SD and DD reports, it may be necessary to submit multiple versions of Monthly Utility Use to cover various alternatives. Individual graphs of Facility Peak, Coincident Peak, Electric Energy and Gas Use showing lines for the Base and Proposed buildings shall be provided in an appendix.

Model Utility Use Data

Energy Model	EUI (kBtu/SF/yr)	Summer electric peak (kW)	Winter electric peak (kW)	Electric energy (kWh/yr)	Electric Cost ($/yr)	Gas (therms/yr)	Gas Cost ($/yr)	Total energy cost ($/yr)	Cost Savings ($/yr)	Incremental cost ($)
Reference Case										
Alternate 1										
Alternate 2										
Alternate 3										
...										

Monthly Utility Use

Base Building	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Facility Peak (kW)*													
Coincident Peak (kW)*													
Electric Energy (kWh)													
Gas Use (Therms)													

Proposed Building	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Facility Peak (kW)*													
Coincident Peak (kW)*													
Electric Energy (kWh)													
Gas Use (Therms)													

Savings	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Facility Peak (kW)*													
Coincident Peak (kW)*													
Electric Energy (kWh)													
Gas Use (Therms)													

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SUBMITTAL REQUIREMENTS

A. At each reporting stage, electronic copies of model input files shall be submitted to the Owner's Project Manager.

END OF SECTION 01 81 13

01 81 19 – INDOOR AIR QUALITY REQUIREMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes information related to indoor air quality requirements for Owner projects. Additional requirements may be included within specific agreements or other contracting documents.

1.03 MATERIALS

A. Indoor Environmental and Air Quality:

1. Reference the current version of LEED requirements for meeting minimum standards for Indoor Environmental and Air Quality.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 81 19

01 91 00 – COMMISSIONING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes information related to commissioning requirements for Owner projects. Additional requirements may be included within specific agreements or other contracting documents.

B. The section is written for larger new construction and renovation projects. Smaller projects shall also adhere to the same intent contained within this section. Specific requirements and alterations to fit the individual project will be determined by the Owner.

1.03 GENERAL

A. Commissioning is a comprehensive and systematic process to verify that the building systems perform as designed to meet the owner's requirements. Commissioning during the construction, acceptance, and warranty phases is intended to achieve the following specific objectives:

1. Verify and document that equipment is installed and started per manufacturer's recommendations and to industry accepted minimum standards.
2. Verify and document that equipment and systems receive complete operational checkout by installing contractors.
3. Verify and document equipment and system performance.
4. Verify the completeness of operations and maintenance materials.
5. Ensure that the Owner's operating personnel are adequately trained on the operation and maintenance of building equipment.
    a. The commissioning process does not take away from or reduce the responsibility of the system designers or installing Contractors to provide a finished and fully functioning product.
    b. The Commissioning Authority is hired by and under contract with the owner. The General Contractor that is awarded the project shall not include the cost of the Commissioning Authority in their price. The General Contractor (and their Sub-Contractors) shall include cost for their involvement in the commissioning process including demonstration of installed equipment to the commissioning team members during the acceptance portion of the project, and other responsibilities as described in the specification.

B. The design intent of the building enclosure is to provide exterior floor, wall, and roof assemblies which prevent uncontrolled air and water infiltration and include products and assemblies that are technically sound, durable and serviceable. This section includes requirements for non-structural commissioning of the building enclosure, including, but not limited to the following:

1. Below-grade construction, including foundation walls and slabs-on-grade.
2. Above-grade construction, including:
    a. Exterior wall materials and assemblies.
    b. Steep-slope and low-slope roofing, outdoor plazas, planters and plaza paving systems and assemblies over occupied space, as well as glazed window, curtain wall and sloped glazing systems.

3. Interface conditions (flashings, expansion joints, sealant) between each of the materials, components and systems that comprise the above and below-grade building exterior enclosure.
4. Thermal and Moisture Protection standards to meet or exceed the City of Fort Collins Code(s).

C. The purpose of the building enclosure commissioning (BECx) is to provide a process for independent third (3rd) party verification that the installed performance of the building enclosure meets or exceeds the minimum performance requirements set forth by the Contract Documents for this project. The materials, components, systems, and assemblies that comprise the above and below-grade building exterior enclosure will be evaluated and tested as outlined in this Section, as well as in accordance with each of the technical Sections associated with the design and construction of the building enclosure.

1.04 DEFINITIONS

A. Commissioning Team: Commissioning Authority (CxA), the Owner's Representative (PM), the General Contractor (GC or Contractor), the Architect and Design Engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the Controls Contractor (CC), the Owner's maintenance staff, and any other installing Subcontractors or Suppliers of equipment.

B. The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB and controls contractor, and those of the electrical contractor are in their respective divisions to support the Commissioning process.

1. All Parties
    a. Attend commissioning scoping meeting and additional coordination meetings, as necessary.
    b. Preliminary HVAC design meeting (required); include the energy model team.
2. Architect/Engineer (A/E): Architect/Engineer of Record
    a. Construction and Acceptance Phase:
        i. Attend the commissioning scoping meeting and selected commissioning team meetings.
        ii. Provide design narrative documentation requested by the CxA.
        iii. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
3. Mechanical and Electrical Designers/Engineers
    a. Construction and Acceptance Phase:
        i. Provide design narrative and sequences documentation requested by the CxA.
        ii. Attend commissioning scoping meetings and other selected commissioning team meetings.
        iii. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
        iv. Review the equipment start-up and pre-functional checklists. Review the functional performance test plans. Witness performance testing
4. Commissioning Authority (CxA): The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E team. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and the Contract Documents.
    a. Construction and Acceptance Phase:

i. Coordinates and directs all commissioning activities in a logical and efficient manner. Work with the GC and PM to ensure that commissioning activities are being scheduled.
ii. Revise, as necessary, the Commissioning Plan.
iii. Plan and conduct a commissioning scoping meeting.
iv. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures, and sequences of operation.
v. Review Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
vi. Develop start-up and checkout plan with Subs. Write and distribute pre-functional checklists.
vii. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.
viii. Review completed pre-functional checklist and start-up reports for Owner approval.
ix. Coordinate any start-up requirements with TAB contractor.
x. Write the functional performance test procedures for equipment and systems. Submit to PM and A/E for review.
xi. Coordinate, witness, and document functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
xii. Maintain a master deficiency and resolution record. Provide the PM with written progress reports and test results with recommended actions.
xiii. Review the training of the Owner's operating personnel.
xiv. Review the preparation of the O&M manuals.
xv. Provide a final commissioning report.

b. Warranty Period:
i. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
ii. Assist in the development of a preventative maintenance plan and review as-built documentation.

5. General Contractor (GC)
a. Construction and Acceptance Phase:
i. Facilitate the coordination of the commissioning work by the CxA.
ii. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
iii. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
iv. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
v. A representative shall attend a commissioning scoping meeting, and other necessary meetings scheduled by the CxA to facilitate the commissioning process.
vi. Coordinate the training of owner personnel.
vii. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
viii. All O&M manuals to be submitted electronically.

b. Warranty Period:

i. Ensure that Subs execute required seasonal or deferred functional performance testing.
ii. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for issues identified in seasonal testing.

6. Mechanical, Controls and TAB Contractors commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors are as follows:
   a. Construction and Acceptance Phases:
      i. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.
      ii. Contractors shall provide the CxA with normal cut sheets and shop drawing submittals of commissioned equipment.
      iii. Provide additional requested documentation, prior to normal O&M manual submittals, to the CxA for development of start-up and functional testing procedures.
      iv. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
      v. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the CxA for all commissioned equipment. Submit to CxA for review and approval prior to startup.
      vi. During the startup and initial checkout process, execute the mechanical-related portions of the pre-functional checklists for all commissioned equipment. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CxA.
      vii. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
      viii. Perform functional performance testing under the direction of the CxA for specified equipment.
      ix. Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA, PM and A/E and retest the equipment.
      x. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
      xi. Provide training of the Owner's operating personnel as specified.
      xii. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
   b. Warranty Period:
      i. Execute seasonal or deferred functional performance testing, witnessed by the CxA, according to the commissioning plan.
      ii. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
7. Electrical Contractors commissioning responsibilities applicable to the electrical contractor may include, but is not limited to, the following items:
   a. Generator.
   b. Sweep or Scheduled Lighting Controls.
   c. Daylight Dimming Controls.
   d. Lighting Occupancy Sensors.

e. Power Quality.
f. Security Systems.
g. Emergency Power Systems.
h. UPS Systems.
i. Fire And Smoke Alarms.
j. Fire Protection Systems.
k. Communications Systems.
l. Public Address/Paging.
m. Distribution Cable.
n. Main Breaker.
o. Ground Default Detection.
p. Automatic Transfer Switch.

C. Building Enclosure: The physical separator between the interior and exterior environments of a building. Typical building enclosure components include the base floor systems, below-grade wall systems, above-grade wall systems (including windows and doors), and the roof systems.
D. Building Enclosure Commissioning (BECx): The process of inspecting and testing building components and assemblies to ensure the installed performance of the building enclosure meets or exceeds the minimum performance requirements set forth by the Contract Documents.
E. Building Enclosure Commissioning Authority (BECxA): The Party retained by the Commissioning Authority which will manage the BECx process, develop and stipulate the BECx requirements, and validate that the components and assemblies are designed, constructed, and tested to meet requirements set forth in the in the Contract Documents.
F. Building Enclosure Commissioning Plan (BECxP): Project-specific protocol developed by the BECxA, which outlines the BECx process for all related components and assemblies. This document will identify the Commissioning Team and include comprehensive checklists and general schedule of all tasks involved in the BECx, including design reviews, construction observations, mockup construction and testing, whole building air leakage testing, and technical reports that will be produced over the course of the Project.
G. Building Enclosure Commissioning Report: The final deliverable from the BECx process, this document includes a full summary report with appropriate documentation including the following information: a narrative describing the BECx items and issues found, a summary and list of enclosure systems and components included in the commissioning program, a description of non-compliant conditions noted during site observations with follow up documentation on the means and methods to resolve, and summary results of building performance testing.
H. Building Enclosure Commissioning Team: Owner and their Consultants, Contractor, Architect/Engineer, Commissioning Authority, and Building Enclosure Commissioning Authority.
I. Commissioning Authority (CxA): The Party responsible for coordinating and carrying out the entire scope of the commissioning process. The Commissioning Authority collaborates with the BECxA to accomplish the building enclosure commissioning.
J. Contract Documents: Documents governing the responsibilities and relationships between Parties involved in the design and construction of this Project, including (but not limited to): Agreements/Contracts, Drawings and Specifications, Addenda, Change Orders, BECx Plan (for reference only).
K. Construction Documents: Refers to the Contract Documents that dictate the details of construction.
L. Contractor: As used herein, 'Contractor' is a general reference to the installing Party and can therefore refer to the General Contractor, Project Manager, Subcontractors, or Vendors as inferred by its usage.

1.05 REFERENCES

A. Current version of the International Energy Conservation Code as amended by the City of Fort Collins – "Design Requirements"
B. City of Fort Collins Building Air Leakage Test Protocol.
C. ASHRAE NIBS Guideline 3 "Exterior Enclosure Technical Requirements for the Commissioning Process".
D. U.S. Army Corps of Engineers "Air Leakage Test Protocol for Measuring Air Leakage in Buildings".
E. ASTM E779 "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization".
F. ASTM E783 "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors".
G. ASTM E1105 "Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference".
H. ASTM E1186 "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems".
I. ASTM E1827 "Standard Test Methods for Determining Air Tightness of Buildings Using an Orifice Blower Door".

1.06 QUALITY ASSURANCE

A. A minimum of four (4) years of experience in the practices that encompass BECx-related consulting services, including all the following:
    1. Performing architectural drawing and specification design peer reviews.
    2. Evaluating submittal compliance.
    3. Administering pre-design and pre-construction meetings.
    4. Performing/supervising relevant field performance and diagnostic testing.
    5. Evaluating as-built component/assembly compliance.
    6. Performing forensic evaluations of as-built construction.
B. A minimum of four (4) years of direct experience in the commissioning of building envelope systems, with a minimum of three (3) projects in commercial and institutional buildings. Experience must include performing/supervising all field performance and diagnostic tests referenced in Part 1.05 of this Specification Section.
C. Level I Certified Infrared Thermographer designation or greater by a nationally accredited certification institution.
D. The building commissioning scope shall be completed prior to the issuance of substantial completion of the project.

1.07 REGULATORY REQUIREMENTS

A. Licensed/Registered Professional Engineer, Licensed/Registered Architect, or a certified commissioning entity (Commissioning Authority) or as listed in the City of Fort Collins Code(s).
B. Building Envelope Analysis: The analysis as conducted through the commissioning process shall include the following tasks:
    1. Prepare Building Enclosure Moisture Management Observations and Building Preparation Survey.
    2. Produce a Building Preparation Measures and Air Barrier Test Plan prior to testing and diagnostics.
    3. Prepare a Building for Whole Building Air and Thermal Barrier Testing and Diagnostics.
    4. Conduct Whole Building Air and Thermal Barrier Testing with Infrared Thermography and Smoke Generation Diagnostics.

5. Produce an Air, Thermal & Moisture Barrier Report; to include test results, diagnostics, recommendations, and prioritized order of magnitude repair or remediation approximated cost estimates.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 91 00

DIVISION 02: Existing Conditions

02 41 13 – SELECTIVE SITE DEMOLITION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for selective site demolition.
   1. Demolition, deconstruction, removal, salvage and disposal of existing site features, fences, structures and materials.
   2. Demolition and removal of concrete sidewalks, curbs and gutters, site concrete and asphaltic paving.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Schedule of items and materials to be salvaged and procedures for disassembly.

B. Manufacturers' take-back and buy-back programs.

1.04 QUALITY ASSURANCE

A. Accurately record actual locations of capped utilities and subsurface obstructions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to commencing any exterior building demolition and removal, either a "Demolition Removal" permit or a "Demolition-Construction" permit must be issued by the City of Fort Collins Building and Zoning Department.

B. Provide, erect, and maintain temporary barriers, enclosures, security fences and shoring at demolition locations.

C. Protect existing structures and utilities that are not to be demolished.

D. Provide temporary wiring and connections to maintain existing telephone, electrical, instrumentation and control systems in service during construction.

E. Protect designated trees and plants from damage.

F. Mark location of existing utilities.

G. Each project shall be identified to determine the extent of recycled and/or reusable content and arrangements to capture those commodities. Goal of seventy-five percent (75%) diversion per project.

H. Disassemble existing construction scheduled to be removed for recycling or reuse, including reclamation by manufacturers' take-back and buy-back programs.

I. Demolition will not be permitted, unless approved by Owner.

END OF SECTION 02 41 13

DIVISION 03: Concrete

03 05 00 – COMMON WORK RESULTS FOR CONCRETE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

B. Section includes administrative and procedural requirements for common work results for concrete. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Provide appropriate documentation for recycled content materials and/or for the origin of regionally sourced materials.

1.04 QUALITY ASSURANCE

A. State tolerances required. Reference: Practice for concrete form work (ACI 347-78).
B. State responsibility for design of form work.
C. All concrete shall be a minimum of three thousand (3,000) psi design strength or as determined by structural consultant.
D. For pre-cast concrete the manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute (PCI).
E. Use re-usable forms to reduce waste.

1.05 REGULATORY REQUIREMENTS

A. Consider crushing and reusing hardened concrete as fill or as a base course for pavement or as aggregate in concrete mix.
B. Source materials regionally where feasible.
C. For mixes that include recycled content, comply with ASTM C 595 regarding mix design in lieu of Portland cement.
D. For the use of fly ash in mixes, comply with ASTM C 618, Class N, F, C. Report chemical analysis of fly ash in accordance with ASTM C 311. Evaluate and classify fly ash in accordance with ASTM D 5759.
E. For use of slag in mixes, comply with ASTM C 989.
F. For use of silica fume in mixes, comply with ASTM C 1240.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall submit tickets for all concrete delivered to site.
    1. Quantity delivered.
    2. Actual quantity of each material in batch.
    3. Outdoor temperature in full sun and shade.
    4. Time at which cement was added.
    5. Time truck left plant, arrived on-site and finished pour.
    6. Numerical sequence of the delivery.
    7. Quantity of water that can be added in the field based on mix design and quantity of water actually added.
    8. Free moisture in fine and coarse aggregate on percent by weight.
    9. Temperature of batch.

PART 2 – PRODUCTS

2.01 MATERIALS
- A. State materials required in form work panels and columns (rectangular, round).
- B. State type of form ties required. Note special requirements.

2.02 EVAPORATION RETARDER
- A. Euclid Chemical “Eucobar”,
- B. Or approved equal.

2.03 COMPOUNDS, HARDENERS, AND SEALERS
- A. Curing and Compounds: ASTM C1315 Type I Acrylic Base
  1. Sonneborn “Kure-N-Seal W”,
  2. Euclid Chemical “Super Diamond Clear VOX”,
  3. Dayton Superior “Day-Chem Cure and Seal (J-21)”,
  4. Or approved equal.
- B. If bonding to the concrete is not required products shall not interfere with bond of adhesive applied flooring.
- C. If bonding to the concrete is required, reference 2.04 and 2.05.

2.04 CURING
- A. Water Curing: Keep concrete continuously wet for 24 hours per day for 7 days by use of potable water, absorptive cover, moisture-retaining cover, or curing paper.
- B. Curing and Compounds: ASTM C309 Type I, Class A and B water-based, dissipating resin.
  1. Euclid Chemical “Kurez DR VOX”,
  2. Or approved equal.

2.05 JOINT FILLING
- A. UV Resistant Polyurea Joint Filler with Shore A Hardness of 85 – 90 available in multiple colors.
  1. Euclid Chemical “Euco QWIKjoint UVR”,
  2. Or approved equal.

2.06 JOINT SEALANTS
- A. Polyurethane sealants with appropriate backer rods.
  1. Euclid Chemical “Eucolastic 1SL” or “Eucolastic 1NS”,
  2. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Interior Slabs on Grade
  1. Allow a minimum of ninety (90) days between the placing of floor slab and installation of joint filler. Thoroughly clean joints of all dirt, laitance and foreign materials.
  2. Saw Cut Joints: Vacuum clean.
  3. Construction Joints: Re-cut to two (2) inches deep. Vacuum clean.
  4. Completely fill joints with filler to bottom of saw cuts without use of backer rod. If crack below saw cut needs to be filled to prevent filler loss, close crack with silica sand. Install filler per manufacturer’s printed instructions. Clean residue with manufacturer’s solvent. Do not open to traffic until filler has cured per manufacturer’s printed instructions.
  5. Vapor barrier goes on top of the gravel, directly beneath the concrete.

3.02 EXECUTION
- A. Define quality of form work construction required (finish, joints, layout.)
- B. State responsibilities for supplying and building-in of inserts (reglets, anchors, water stops, etc.)
- C. State minimum stripping and re-shoring requirements.

D. Provide description of various types of formed surfaces required for the project.
E. State that all tie penetrations to be grouted and properly sealed to prevent moisture from entering the foundation walls.
F. State that all exposed concrete walls and foundations to have holes filled, burs removed and walls rubbed.

END OF SECTION 03 05 00

03 20 00 – CONCRETE REINFORCING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for concrete reinforcing. Additional requirements may be included within specific agreements or other contracting documents.
- B. Steel Reinforcing.
- C. Synthetic Macro Fiber Reinforcing.

1.03 SUBMITTALS REQUIRED
- A. Statement of proposed inspection and testing.
- B. State shop drawing requirements not covered in General Conditions, such as scale, standard (e.g. ACI 315-74) and any special items to be covered.

PART 2 – PRODUCTS

2.01 MATERIALS
- A. State quality of reinforcement to be used including both rods and welded wire fabric.
- B. Define requirements for bending (i.e. standards, shops versus field bending.)
- C. Steel reinforcing shall be Grade 60 or as recommended by the structural consultant. This shall be coated to prevent corrosion.
- D. Synthetic Macro Fiber Reinforcing can be used for all concrete slabs.
  1. Euclid Chemical “Tuf-Strand SF”,
  2. Or approved equal.
- E. Use Synthetic Micro Fibers in all slabs and composite metal decks to reduce plastic and crazing cracking.
  1. Euclid Chemical “PSI Fiberstrand 150”,
  2. Or approved equal.

PART 3 – EXECUTION

3.01 EXECUTION
- A. State standards for placing include cover, spacing and chairing.

END OF SECTION 03 20 00

03 30 00 – CAST-IN-PLACE CONCRETE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for cast-in-place concrete. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Require records of all concrete delivered to site including date, delivery slip number, location in project, test made, and weather conditions.
- B. Require submittal of concrete mix for approval before work commences.
- C. State testing proposed and who will appoint and pay the testing company.
- D. State environmental restrictions to be adhered to (i.e., define “cold” and “hot” weather) and protection required.

PART 2 – PRODUCTS

2.01 MATERIALS
- A. State requirements for water, cement aggregate for the project including any special requirements such as white cement, sulfate resisting cement, colored aggregate, etc.
- B. Define admixtures required such as water reducing, air entraining, etc.
- C. Define water stops to be used.
- D. Define other products required for the work such as non-shrink grout, curing agents, polyethylene, etc.
- E. Concrete Mix: Define requirements for mix design such as by whom, specified strength versus durability to environment, special density, placing requirements, etc.
- F. Maximum shrinkage limit of cast-in-place concrete:
  1. Varies based on the requirements of the job. Consult Owner for requirements.

2.02 INTERIOR CONCRETE STEPS
- A. Provide each set tread with extruded aluminum nosing running full width of tread and landings at leading edge. Stairway nosing shall be color two (2) inch wide with slip-resistant abrasive that contrasts with the tread material.

PART 3 – EXECUTION

3.01 EXECUTION
- A. State requirements for placing, including vibrating, suitability of ground forms to receive concrete, protection from weather, precautions to ensure uniform pour to obviate cold joints, honeycombing, etc., and pumping.
- B. State requirements for cold weather placement, ground shall not be frozen and the outside air temperature shall be minimum twenty-eight (28) degrees Fahrenheit and rising at the time of placement.
- C. State requirements for construction, control, and expansion joints.
- D. Define where water stops are required if not covered on drawings.

E. State any requirements to apply to other trades such as mechanical, electrical, and structural steel.
F. Define requirement for finishing concrete such as for paint, sandblasting, bushammering, etc.
G. State requirements for saw cutting such as timing, spacing, depth and finishing.
H. Form release agents (form oil) to be contained to the formwork. It is not to get on the reinforcing materials or the earth.

END OF SECTION 03 30 00

03 35 43 – POLISHED CONCRETE FINISHING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for polished concrete finishing. Additional requirements may be included within specific agreements or other contracting documents.

B. Materials and/or installer may be approved equal to be determined before documents go to bid by Architect/Engineer and Owner.

1. Rilem Test Method 11.4 Standard Measurement of Reduction of Moisture Penetration through Horizontal Concrete Surfaces.

C. Spec written to reflect the strict requirements of manufacturer will accept another installer/material if the exact same specifications can be met (i.e.: 1800 polish, penetrating stain, etc).

1.03 SUBMITTALS REQUIRED

A. Mock-up:

1. Mock-up Size: One hundred (100) square feet sample panel at jobsite.
2. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
3. Mock-up to be done using same crew and equipment as will be used for the Work.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications:

1. Not less than three (3) years' experience.
2. Member of the CPAA (Concrete Polishing Association of America).
3. Trained and holding current certification for installation.
4. Must have a thirty-six (36) inch or larger with twenty (20) horsepower or more grinder with a walk behind or ride on floor scrubbers, as needed to properly do the work.
5. No dumping of concrete into slurry pit will be acceptable. May have to own a slurry separator. Legally dispose of slurry which is to be put into a concrete slurry separator and made into a solid and then disposed into a trash bend. The clean water that remains must be made to a PH below nine (9) and above six (6).

B. Performance:

1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008-inch wear in thirty (30) minutes.
2. Reflectivity: Increase of thirty-five percent (35%) as determined by standard gloss meter.
3. Waterproof Properties: Rilem Test Method 11.4, seventy percent (70%) or greater reduction in absorption.
4. High Traction Rating: NFSI 101-A, non-slip properties.
5. NFSI Test Method 101-A Phase Two Level High Traction Material. System must be certified by the NFSI for a Certified High Traction Floor.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect from petroleum stains during construction.

B. Diaper hydraulic power equipment.

C. Restrict vehicular parking.
D. Restrict use of pipe cutting machinery.
E. Restrict placement of reinforcing steel on slab.
F. Restrict use of acids or acidic detergents on slab.
G. Fort Lift Tires need to be covered in order not to have sheet rock nails in tires which will scar concrete slab.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. Hardened Concrete Properties:
   1. Minimum Concrete Compressive Strength: Three thousand-five hundred (3,500) psi (24 MPa).
   2. Normal Weight Concrete: No lightweight aggregate.
   3. Non-air entrained.
B. Placement Properties:
   1. Natural concrete slump of four and a half (4½) inches to five (5) inches. Admixtures may be used.
   2. Flatness Requirements:
      a. Overall FF 50.
      b. Local FF 25.
C. Hard-Steel Troweled (three (3) passes) Concrete: No burn marks. Finish to ACI 302.1R, Class 5 floor.
D. Concrete Flat Company must be ACI Certified.

2.02 MATERIALS

A. Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film. The compound must contain a minimum solids content of twenty percent (20%) of which fifty percent (50%) is siliconate.
   1. Euco Diamond Hard by Euclid Chemical,
   2. FGS Permashine by L&M Construction Chemicals,
   3. Or approved equal.
B. Joint Filler: Semi-rigid, two (2) component, self-leveling, one hundred percent (100%) solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness. Color to be selected from manufacturer's color chart.
   1. QWIKjoint UVR by Euclid Chemical,
   2. Or approved equal.
C. Concrete Dyes: Fast-drying dye packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces. Color to be selected from manufacturer's color chart.
   1. Increte Color-Crete by Euclid Chemical,
   2. Or approved equal.
D. Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
   1. Euco Clean & Strip by Euclid Chemical,
   2. Or approved equal.
E. Finish: High Gloss, 1,800 grit.

F. Color: To be approved with mock-up.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify Concrete Slab Performance Requirements: If new concrete:
   1. Verify concrete is cured to twenty-eight (28) days, three thousand-five hundred (3,500) psi (24 MPa) strength.
   2. Verify concrete surfaces received a hard steel-trowel finish (three (3) passes) during placement.

3.02 INSTALLATION

A. Apply hardener, sealer, densifier in accordance with manufacturer's written instructions.

END OF SECTION 03 35 43

03 45 00 – PRECAST ARCHITECTURAL CONCRETE

5/25

PART 1 – GENERAL

1.02 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.03 SUMMARY
- A. Section includes administrative and procedural requirements for precast architectural concrete.
  1. Wall copings.
  2. Supports, anchors and grouting.
  3. Cleaning and sealing unit.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.04 QUALITY ASSURANCE
- A. Erection shall be done by qualified masons having experience in the successful installation of similar architectural precast work.
- B. Offset from true alignment between two (2) connecting members: One-quarter (¼) inch maximum.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Precasters:
  1. Continental Cast Stone Manufacturing, Inc.
  2. Fort Collins Precast, Inc.
  3. Or approved equal.
- B. Surface Sealer:
  1. Dayton Superior Weather Worker S-40, Euclid Chemical “Baracade Silane 40 WB”, or approved equal.
  2. VOC compliant, forty percent (40%) silane sealer; non-darkening; no surface film.
- C. Cleaner: ProSoCo Products, Inc., “Sure Clean” No.600, Euclid Chemical “Euco Clean & Strip”, or approved equal.
- D. Surface Retarder: Burke “True Etch” form retarder and True Etch Release, or Euclid Chemical “Concrete Surface Retarder”, or approved equal.

2.02 JOINT SEALANTS
- A. Polyurethane sealants with appropriate backer rods.
  1. Euclid Chemical “Eucolastic 1SL or Eucolastic 1NS”,
  2. Or approved equal.

2.03 EPOXY
- A. Euclid Chemical “Dural 452 Series”,
- B. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Apply two (2) part masonry setting epoxy in drilled holes to receive dowels and anchor slots.

B. Set units on top of ice and water guard membrane using shims to provide correct mortar joint height. Remove shims when epoxy is dry and before sealant application. Slush vertical joints full with mortar
C. Bed and head joints shall be three-eight (3/8) inch-thick; maintain uniform joints. Set units in mortar raking joints back for sealant installation.
D. Tuck point Precast stone units with pointing mortar and tool joint concave to match adjacent brick masonry.

END OF SECTION 03 45 00

03 60 00 – GROUT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for grout.
   1. Under steel column bearing plates.
   2. Under steel beam bearings.
   3. Under precast concrete column covers.
   4. At elevator sills.
   5. Under site lighting standard base plates.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Samples.

PART 2 – PRODUCTS

2.01 NON-SHRINK GROUT OR DRYPACK

A. Non-Metallic Grout: Meet performance requirements of ASTM C1107.
   1. U.S. Grout Corporation "Five Star Grout".
   2. Master Builders "Master Flow 928".
   3. L&M Chemicals "Crystex".
   4. Euclid Chemical Company "HiFlow Grout or NS Grout".
   5. Cormix Construction Chemical Co. "Supreme".
   6. Or approved equal.

B. Provide minimum twenty-eight (28) day compressive strength of six thousand (6,000) psi.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 03 60 00

03 90 00 – CONCRETE FINISHING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for concrete finishing. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 GENERAL FINISH TYPES

A. Concrete to match existing, as close as possible, in current buildings on any City facility or project.

Finish Types	**Location**
Screened with Bull Float	Skim coats, pits
Screened, Bull Floated and scored with wire brush	Base slab for tile or bonded topping
Powered steel trowel finish	Floors which receive resilient flooring, carpet, or future floor
Powered steel trowel finish	Interiors exposed slabs with non-slip swirls
Wood float finish with brooming	Exterior exposed slabs
Hardened concrete with powered steel trowel	Exposed slabs in shipping receiving and hockey rink slabs
Broom finish	Exposed concrete ramps

2.02 FLOOR SEALER

A. Use only non-toxic and VOC free sealers.

PART 3 – EXEUCTION

3.01 EXECUTION

A. Curing

1. Specify method of curing that is compatible with floor finished to be applied. Do not use a curing compound on floors or stairs to be painted.

END OF SECTION 03 90 00

DIVISION 04: Masonry

04 05 00 – COMMON WORK RESULTS FOR MASONRY

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for common work results for masonry. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS
- A. Product Data.
- B. Samples.
- C. Design Criteria.
- D. Test Reports.
- E. Manufacturer's Certificates.
- F. Manufacturer's Instructions.
- G. Shop Drawings.
- H. O&M Data.
- I. Submittals requiring approval from the Architect/Engineer shall include the stamp of the licensed professional, licensed in the State of Colorado.
- J. Owner approval is required for all submittals.

1.04 QUALITY ASSURANCE
- A. Perform work in accordance with industry standards, including hot and cold weather requirements.
- B. Observe environmental precautions based on conditions.
- C. Provide special inspections as required by all applicable Codes and Standards or as directed by the Owner.
- D. Mock-up Panel: After material samples are approved and prior to starting masonry work, construct a mock-up panel for each type and color of masonry required.
- E. Do not install any masonry products which are damaged, including but not limited to chips, broken corners, cracks, etc. Removal and replacement of damaged masonry shall be at no cost to the Owner.

PART 2 – PRODUCTS

2.01 MASONRY UNITS
- A. Use compressive strength as applicable to the type of wall and application.
- B. Type SW (severe weather) shall be used below grade and where exposed to freezing.
- C. Use normal weight concrete block for foundation walls and walls exposed to weather. Do not use lightweight block in these locations. Use bull nosed units for exposed corners.
- D. Choose materials which will minimize efflorescence.

2.02 CONTROL JOINTS
- A. Incorporate vertical shrinkage control joints in wall of which masonry is a component.

B. Provide control joints inline of door opening jambs from head to top of wall.
C. Space control joints based on applicable published masonry institute publications and applicable Codes.
D. Provide complete vertical separation through walls incorporating control joints.

2.03 JOINT REINFORCEMENT

A. Provide vertical and horizontal joint reinforcement for all masonry walls, thickness and spacing based on the type of wall, height of wall, and design conditions.

2.04 WEATHER PROTECTION

A. Provide weather protection for all free-standing structures, walls and floors until complete. Exterior masonry walls are to be impervious to moisture penetration from driving rain.
B. Keep mortar and grout from freezing until it has achieved desired strength.

2.05 CAVITY WALLS

A. Provide free draining weep holes at bottom of cavity walls and over through wall flashings. Install flashings in accordance with the IBC.

2.06 JOINTS

A. Tool all joints between masonry units with joint finishing tool as recommended by material manufacturer to seal mortar properly to resist moisture penetration. This practice shall be used even if this side of block is hidden from view.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 04 05 00

04 05 13 – MASONRY MORTAR AND GROUT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for masonry mortar and grout. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS
- A. Submit product data, samples, design criteria, test reports, manufacturer's certificates, instructions, shop drawings, and O&M data for Owner review.
- B. Submittal requiring approval from the Architect/Engineer shall include the stamp of the licensed professional, licensed in the State of Colorado.
- C. Owner approval is required for all submittals.

1.04 QUALITY ASSURANCE
- A. Perform work in accordance with industry standards, including hot and cold weather requirements.
- B. Observe environmental precautions based on conditions.
- C. Provide special inspections as required by all applicable Codes and Standards or as directed by Owner.
- D. Mock-up Panel: After material samples are approved and prior to starting masonry work, construct a mock-up panel for each type and color of masonry required.

PART 2 – PRODUCTS (NOT USED)

2.01 MANUFACTURERS
- A. Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

2.02 PRODUCTS
- A. Mortar
  1. Components
     a. Portland Cement: ASTM C150, Type I.
     b. Mortar Aggregate: ASTM C144, standard masonry type.
     c. Hydrated Lime: ASTM C207, Type S.
     d. Mortar Color: Portland cement, lime and mortar pigment shall be pre-mixed and delivered to the site in bags. Site blending of mortar pigment with cement and lime is not allowed.
     e. Water: Clean and potable.
     f. Bonding Agent: Latex type.
  2. Admixtures: Air-entraining admixtures or cementitious materials containing air-entraining admixtures, antifreeze compounds or other substances which lower freezing point of mixing water and calcium chloride or admixtures containing calcium chloride shall not be used in mortar. Obtain Owner approval for projects which may have special circumstances.

3. Mortar Mixing:
    a. Do not use anti-freeze compounds to lower freezing point of mortar. Area air temperatures and materials shall be thirty-four (34) degrees Fahrenheit and rising for mortar placement.
    b. The same brand of Portland cement shall be used in succeeding batches of mortar to produce uniform mortar color. When necessary to change brands of cement, mix shall be adjusted to compensate for color differences.
    c. If masonry is connecting to an existing building, then the mortar shall match unless approved by the Owner
    d. Masonry cement shall not be used.

B. Masonry Grout
    1. Mixes: Do not use anti-freeze compounds to lower freezing point of grout

PART 3 – EXECUTION

3.01 INSTALLATION

A. Lay units plumb.

B. Perform all grouting by means of low-lift technique. Do not use high-lift grouting methods. Limit height of pours to five (5) feet. Limit height of masonry to one (1) foot, four (4) inches above each pour. Pour grout only after both vertical and horizontal reinforcing is in place. Hold grout down one inch from top of masonry unit at reinforced vertical cells except at bond beams and block lintels. Place grout for each pour continuously and consolidate immediately. Do not interrupt pours for more than one and one-half (1½) hours.

C. Hollow metal frames in masonry walls shall be slushed full of mortar or grout.

END OF SECTION 04 05 13

04 20 00 – UNIT MASONRY

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for unit masonry.
   1. Brick.
   2. Concrete masonry units, and assembly.
   3. Water repellent concrete masonry units.
   4. Joint reinforcement, anchorage and accessories.
   5. Installation of steel reinforcing within masonry units or construction to include bond beams, concrete block lintels, and piers.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS

A. Submit product data, samples, design criteria, test reports, manufacturer's certificates, instructions, shop drawings, and O&M data for Owner review.

B. Submittal requiring approval from the Architect/Engineer shall include the stamp of the licensed professional, licensed in the State of Colorado.

C. Owner approval is required for all submittals.

1.04 QUALITY ASSURANCE

A. Standards:
   1. Perform Work in accordance with Masonry Standards Joint Committee (MSJC) Code (ACI 530/ASCE 5/TMS 402) and MSJC Specification (ACI 530.1/ASCE 6/TMS 602).
   2. Standards for concrete masonry work, procedures and materials shall be latest specifications of the National Concrete Masonry Association (NCMA).
   3. Standards for brick masonry work, procedures and materials shall be latest specifications of the Brick Institute of America (BIA).

B. Performance Requirements:
   1. Water Permeance of Masonry: Use of water repellent admixtures capable of providing masonry assembly performance of a Class E Rating when evaluated using ASTM E 514.
   2. Flexural Bond Strength of Masonry: No statistically lower masonry flexural bond strength shall occur because of adding integral water-repellent CMU admixtures when compared to a control (containing no admixtures) CMU when tested according to ASTM C 1357.
   3. Compressive Strength of Masonry Prisms: No statistically lower compressive strength of prisms shall occur because of adding integral water-repellent CMU admixtures when compared to a control (containing no admixtures) CMU when tested according to ASTM C 1314.

C. Tolerances:
   1. Maximum Variation from Plumb: One-quarter (¼) inch per story non-cumulative; one-half (½) inch in two (2) stories or more.
   2. Maximum Variation from Level Coursing: One-eighth (1/8) inch in three (3) feet, one-quarter (¼) inch in ten (10) feet and one-half (½) inch in thirty (30) feet.
   3. Hot and Cold Weather Requirements: Masonry Standards Joint Committee (MSJC).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance.
B. Cover and protect masonry units from precipitation.
C. Delivery cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturer's names and brands. Store in dry, weathertight enclosures or completely cover.

1.06 REGULATORY REQUIREMENTS

A. Observe environmental precautions based on conditions.

PART 2 – PRODUCTS

2.01 COMPONENTS

A. General: The specified compressive strength of masonry shall be determined by the Architect/Engineer for each type of masonry and condition.
B. Replace Portland cement and aggregate materials, where feasible, with industrial waste byproducts such as air-cooled slag, cinders, fly ash, ground waste glass and concrete, granulated slag, and expanded slag.
C. Do not change the source of materials, which will affect the appearance of the finished work, after the work has started.
D. Concrete Masonry Units:
    1. Hollow Load Bearing Concrete Masonry Units: ASTM C90, Type I.
        a. Special Shapes:
            i. Bullnose internal vertical corners and sills. Bullnose required at exterior corners at all corridors, kitchens, gyms, and inset door frames.
            ii. Provide jamb units of the shapes and sizes to confirm with wall units.
    2. Hollow Non-Load Bearing Concrete Masonry Units: ASTM C129.
        a. Special Shapes:
            i. Bullnose internal vertical corners and sills. Bullnose required at exterior corners at all corridors, kitchens, gyms, and inset door frames.
            ii. Provide jamb units of the shapes and sizes to confirm with wall units.
    3. Solid Concrete Masonry Units: ASTM C90.
    4. Fire-Rated Construction: Provide concrete masonry units in composition and thickness required to meet the required fire resistance rating.
    5. Split-Faced Unit Masonry: ASTM C90 or ASTM C129, moisture controlled, integral color. Integral water repellant units for exterior wall locations.
    6. Ground-Faced Unit Masonry: ASTM C90 and ASTM C-744, moisture controlled, integral color. Integral water repellant units for exterior wall locations.
E. Fired Clay Brick: ASTM C216, Type FBX, Grade SW or approved equal.
    1. Size: Modular.
    2. Special Shapes: Solids and bullnose. Solid units at all rowlock sills and other areas where use of a cored brick will be exposed to view.
    3. Limit unites on the project to those that conform to the approved sample.
F. Precast Concrete Units: Provide precast concrete units, trim, lintels, copings, splash blocks and sills that are factory-made units.
G. Cast Ston Units: ASTM C1364 or approved equal. Provide cast stone units, trim, lintels, copings, and sills that are factory-made units.

2.02 MASONRY QUALITY

A. Concrete masonry units shall have even, “closed” texture. Blocks with rough, “popcorn” surfaces shall be rejected.
B. Masonry with checks, spalls, and similar defects shall not be used where exposed.
C. Sharp, square corners required. Do not lay block with damaged sides, edges or corners. There shall be no imperfection bigger than a dime or deeper than one-quarter (¼) inch in a block face on a finished wall.
D. Furnish special units for ninety (90) degree corners and lintels.
E. Required Bullnose block shall be formed without lines at the bullnose or lines shall be ground off prior to block filling.
F. Lintel block shall have finished bottoms if exposed below.
G. Mortar joints shall be struck leaving concave joint unless noted otherwise and sled runners shall be used on long mortar joints to give a uniform appearance.

2.03 JOINT REINFORCEMENT

A. Factory fabricate joint reinforcement in conformance with ASTM A951 welded construction. Joint reinforcement may be furnished with adjustable wall tie features if approved by the Architect/Engineer.
B. Coated Steel Wire:
    1. Wire: ASTM A82 and Federal Spec QQ-W-461f.
    2. Finish: Mill galvanized finish ASTM A641 to meet ACI 530.1 requirements.
        a. Class I Interior Walls.
        b. Class III Embedded Exterior Masonry.
    3. Finish: Hot Dip Galvanized ASTM A153 to meet ACI 530.1 requirements.
        a. Class 2 Partially Embedded Exterior Masonry.
        b. High Humidity Interior Space Walls.
    4. Finish: Stainless steel.
C. Wire Sizes (Deformed side rods; smooth cross rods): Provide standard weight, nine (9) gauge side rods, nine (9) gauge cross rods or as specified by the Architect/Engineer.
D. Single Wythe Joint Reinforcement: Provide ladder type, standard weight or as specified by the Architect/Engineer.
E. Cavity Wall Joint Reinforcement: Provide ladder type, three (3) wire system, standard weight or as specified by the Architect/Engineer.

2.04 ANCHORS AND WALL TIES

A. Anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of five-eighth (5/8) inch mortar cover from face of masonry.
B. Strap Anchors:
    1. Weld on anchors and wall ties for anchoring masonry to steel columns.
    2. Hot dip galvanized for exterior application; mill galvanized for interior applications.
    3. Stainless Steel.
C. Adjustable Wall Ties: Provide adjustable type wall ties that consist of two elements which allow movement.
D. Formed Steel Wall Ties:
    1. Ties for Spray Polyurethane Foam: Hot dipped galvanized per ASTM A153, Class B.

2.05 THROUGH WALL FLASHING AND WEEPS

A. Flashing: Provide coated copper, copper, or stainless-steel sheet, self-adhesive rubberized sheet, or reinforced membrane sheet flashing which is not adversely affected by damp-proofing material.
B. Drip Edge: Provide stainless steel drip edge with hemmed edges and down-turned drip at the outside edge and upturned dame at the inside edge for use with flashing membranes.

2.06 ACCESSORIES

A. Plastic Flashing: Sheet polyvinylchloride, two hundred (200) millimeters thick. Furnish with compatible adhesive.
B. Preformed Control Joints: Rubber or neoprene material; with corner and tee accessories; style to fit conditions.
C. Joint Fillers: Self expanding closed cell polyethylene or rubber. Oversized fifty percent (50%) to joint width.
D. Joint Fillers for Fire Rated Construction: ASTM E84.
E. Hardware Cloth: One-quarter (¼) inch galvanized mesh cloth forms. Install below "knock-out" type bond beam units or elsewhere required to contain grout.
F. Cavity Drainage: Provide full cavity width, compressible, open weave mesh water drainage mat that suspends mortar droppings above flashing and weeps to promote better air flow and moisture management.
G. Weeps: Pre-manufactured weep vents that restrict insects and allow drainage, color to match surrounding mortar.
H. Air Vents (top of wall): Pre-manufactured vents that restrict insects and allow drainage, color to match surrounding mortar.
I. Steel Column Wrap: Two (2) layers, 30# asphalt saturated building felt.
J. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

2.07 MASONRY CLEANING

A. Cleaning Solution for Brick Only: Non-acidic, not harmful to masonry work or adjacent materials.

2.08 MASONRY SEALERS

A. Concrete Masonry Sealer (Interior walls where no paint is scheduled:
    1. Masonry:
        a. Alkaline stable, ninety percent (90%) minimum water vapor transmission, clear hundred percent (100%) acrylic.
        b. Waterproofing for Below Grade CMU: Provide bonded, adhered, or liquid applied product as specified by the Architect/Engineer.

PART 3 – EXECUTION

3.01 GENERAL

A. Spacings and locations indicated in Part 3 shall not supersede the design provided by the Architect/Engineer for the specific project. Installation information is intended to assist in conveying the Owner's desires. The Architect/Engineer is responsible for all design specifications and criteria.

3.02 PREPARATION

A. Coordinate placement of anchors, lintels, bearing plates, hollow metal frames and other materials.

3.03 INSTALLATION

A. General:
    1. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Maintain open (clean) cells (cores) at return airways. Remove mortar that protrudes from joints on inside of block cores (mortar fills) to provide maximum clear airway.
    2. Coursing of Concrete Masonry Units:
        a. Bond: Running. Stack bond at Vertical Center Score units.
        b. Coursing: One (1) unit and one (1) mortar joint to equal eight (8) inches.
        c. Mortar Joints: Concave, unless noted otherwise.

d. Provide bullnose corners at all interior vertical ninety (90) degree corners and windowsills.
e. Mortar and tool all CMU joints including scores.
f. CMU lintels shall be U-shaped, solid bottom units.

3. Coursing of Brick Units:
   a. Bond: Running.
   b. Coursing: Three (3) units and three (3) mortar joints to equal eight (8) inches.
   c. Mortar Joints: Concave.
4. Cut mortar joints flush at the following locations:
   a. Where resilient base or carpet base is scheduled.
   b. Where ceramic or quarry wall tile is scheduled.
   c. At CMU against which rigid insulation is applied.
   d. At CMU to be dampproofed or waterproofed.
   e. At CMU to which adhesive and plastic flashing will be applied.
5. Three (3) brick courses shall lay to the same height as one block course so reinforcing will lay through both wythes at the same level.
6. Placing and Bonding:
   a. Isolate masonry partitions from vertical structural framing members with movement joints.
   b. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler. Fill deck flutes full. Use rated joint filler at rated masonry walls.
   c. Isolate non-bearing masonry partitions on concrete slabs on grade from bearing walls occurring on foundations. Keep joints clean for sealants.
7. Weeps and Vents: Install weeps and vents in outer wythe at one (1) foot, four (4) inches o.c. horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
8. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weep or vent holes. Build inner wythe ahead of outer wythe to receive cavity insulation. Install cavity drainage material to prevent blockage of weeps/vents.
9. Fully embed steel anchors in grout or mortar. Provide hardware cloth to form bottom of mortar/grout embed minimum four (4) inches below anchors.
10. Form openings neatly with clearances to pipes and equipment that can be covered with standard escutcheons or trim.
11. Fit compressible joint filler around all penetrations through masonry walls. Use rated joint fillers in rated walls.
12. Fill hollow metal frames in masonry walls with mortar or grout. Maintain uniform joint between masonry and hollow metal frame of approximately one-quarter (¼) inch, with a neat concave tooled joint.
13. Bed anchors of door and window frames in adjacent mortar joints. Fill adjacent block cores completely around perimeter of frames, reinforced with continuous #5 reinforcing rod.
14. Provide minimum sized cut outs for electrical boxes, thermostats, and other devices so that device covers fully conceal the cut out.
15. Install bracing to structure for interior masonry partitions extending above ceilings, but not to structure, at eight (8) feet o.c. maximum.
16. Where masonry walls are constructed on slabs on grade, install control joints adjacent to exterior walls located on independent foundations. Do not structurally connect masonry walls perpendicular to one another.

17. Sound Insulating Partitions: Do not allow gaps of greater than one-half (½) inch. Fill all gaps with acoustical caulk or sealant.

3.04 JOINT REINFORCEMENT AND ANCHORAGE – SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement one (1) foot, four (4) inches o.c. Place joint reinforcement continuous in first and second joint below top of walls.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum one (1) foot, four (4) inches each side of opening, unless control joints are located at openings, in which case terminate reinforcement at control joint.
C. Horizontal reinforcement in stack bond walls shall be placed eight (8) inches o.c. Reinforce joint corners and intersections with strap anchors eight (8) inches o.c.
D. Lap reinforcement a minimum of six (6) inches at splices. Fully lap at corners and intersections or provide factory fabricated units.
E. Coordinate coves and reinforcement placement of return airways so air movement is not interrupted.

3.05 JOINT REINFORCEMENT AND ANCHORAGE – MASONRY VENEER

A. Stud and Sheathing Framed Backing: Secure formed steel wall ties to studs and embed into masonry veneer at maximum one (1) foot, four (4) inches o.c. vertically and two (2) feet, eight (8) inches o.c. horizontally. Place at maximum eight (8) inches o.c. each way around perimeter of openings, within one (1) foot, four (4) inches of openings.
B. Reinforce stack bond unit corners and intersections with strap anchors one (1) foot, four (4) inches o.c. vertically.

3.06 JOINT REINFORCEMENT AND ANCHORAGE – CAVITY WALL MASONRY

A. Install horizontal joint reinforcement one (1) foot, four (4) inches o.c. Place joint reinforcement continuous in first and second joint below top of walls.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum one (1) foot, four (4) inches each side of opening.
C. Build inner wythe ahead of outer wythe to receive fabric flashing and cavity insulation.

3.07 ANCHORING MASONRY TO STEEL COLUMNS

A. Weld strap anchor plates to steel columns to permit embedment of anchors into masonry at one (1) foot, four (4) inches o.c. on each face of the column. Coordinate work with placement of column wrap. Maintain space between masonry and columns to provide for movement.

3.08 GROUTED COMPONENTS

A. Maintain open (clean) cells (cores) at return airways. Remove mortar that protrudes from joints on inside of block cores (mortar fills) to provide maximum clear airway.
B. Lay units plumb, in bond to preserve the unobstructed horizontal or vertical continuity of the cells to be grouted full.
C. Lay in full mortar beds; cross webs adjacent to vertical cores which are to be filled with grout shall be fully bedded.
D. Remove mortar fins from continuous grouted cell; keep cell clean, free of mortar and debris. Provide clean out at bottom of cell if necessary to remove debris. Positive drainage is required.
E. Support and secure reinforcing bars from displacement; maintain position within one-half (½) inch of dimensioned position.
F. Place and consolidate grout without displacing reinforcement. Do not allow grout to enter return airways.
G. Grout shall be vibrated to ensure complete filling of the cells. At breaks in grout pour hold grout one and one-half (1½) inches below top of masonry unit.

H. In filling vertical cells, the grout pour shall not exceed five (5) feet in height. High lift grouting techniques may be considered for use if the proposed methods are specifically reviewed and approved.
I. Install hardware cloth under “knockout” bond beams except at vertically reinforced zones. Where control joints intersect bond beams, interrupt bond beam reinforcement and concrete.
J. Reinforced Zones:
    1. Per Structural design details.
K. Place vertical reinforcing rods into concrete foundation walls during pouring.
L. Fill masonry cores with grout, set nailing strips, anchor bolts, etc. for wall mounted fixtures and equipment.

3.09 MASONRY FLASHINGS

A. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, and adhere to stainless steel drip.
B. Turn flashing up minimum eight (8) inches and bed into mortar joint of masonry, seal to concrete, or seal to sheathing over stud framed back-up using recommended adhesive.
C. Lap end joints and seal watertight.
D. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.10 LINTELS

A. Install loose steel or reinforced unit masonry “U” block lintels over openings.

3.11 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.
B. Use control joint with standard sash block. Rake out mortar in preparation for sealants.
C. Install preformed control joint device in continuous lengths. Seal end, butt, and corner joints in accordance with manufacturer’s instructions.
D. Locate vertical control joints in all masonry walls. Do not locate control joints through or at the ends of bond beam opening lintels.

3.12 INSULATION INSTALLATION

A. Cavity Walls - Foam Insulation: (if used).
    1. Do not install exterior wall veneer until the exterior foam insulation is completed.

3.13 .POINTING AND CLEANING

A. Promptly remove excess wet mortar containing integral water-repellent mortar admixture from the face of the masonry as work progresses. Do not use strong acids, overaggressive sandblasting or high-pressure cleaning methods.
B. Exposed Masonry: At completion of work, point holes in joints of exposed masonry surfaces; completely fill with mortar; tool property.
C. Fill remaining pinholes, minor holes or depressions in concrete masonry units; match block texture. Repeat operation where holes or voids are apparent after first coat of block filler, and subsequent painting coats.
D. Sandblasting of exterior concrete masonry units to be approved by Owner per project.
E. At bull nosed corners, grind as necessary to provide a smooth corner.

3.14 SEALING MASONRY

A. Apply sealer to four (4) foot by four (4) foot test area for mock-up review and approval.
B. Seal unpainted surfaces of interior concrete masonry units.

END OF SECTION 04 20 00

DIVISION 05: Metals

05 05 00 – COMMON WORK RESULTS FOR METALS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for metals. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. State special shop drawing requirements such as scale and what special items are to be covered.

1.04 QUALITY ASSURANCE
- A. Fabricator: Approved fabricator as specified in IBC Section 17042.2. Submit proof of registration with shop drawing submittal.
- B. Erector: Minimum five (5) years' experience in erection of structural steel.
- C. Welder: Certification by AWS Standard Qualification Procedures. Welders shall have passed AWS qualification test within previous twelve (12) months. Provide welding process and welding operations in accordance with AWS D1.1.
- D. Establish required leveling and plumbing measurements on the mean operating temperature of the structure. Make allowances for the difference between the temperature at the time of erection and the mean temperature at which the structure will be when completed and in service.
- E. All load-bearing, metal components shall be designed and signed and sealed by a licensed professional Engineer and/or Structural Engineer licensed in the State of Colorado.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Packing and Shipping of Materials: Deliver materials properly marked to identify location of each steel component. If structural steel will be exposed to view and receive a painted finish, mark steel with non-telegraphing spray paint. No marker or crayon.
- B. Deliver sheet metal fabrications as factory assembled units with protective crating and covering.
- C. Store steel on elevated platforms in a dry location and protect from corrosion. Protect primed surfaces.
- D. Store on platform or skids, upright to prevent twisting, and to SJI requirements.

1.06 REGULATORY REQUIREMENTS
- A. Observe environmental precautions based on conditions.
- B. Testing and Inspection: State testing and inspection required and how it is being paid for and who will appoint the company.

PART 2 – PRODUCTS

2.01 PRODUCTS
- A. See Division 01 for general sustainability requirements.
- B. Standard hot rolled sections, hollow structural sections, cold rolled sections, plates and fasteners.

C. All below grade steel to be galvanized.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Special items to be noted (e.g., masonry anchors holes in members, requirements of other trades, base plate setting method, etc.)
B. Contractor to submit steel erection notice verifying foundations have reached required strength for steel erection to proceed with construction.

3.02 FIELD QUALITY CONTROL

A. The Owner usually employs an independent testing agency to provide field inspection of members, connections, and welds.
B. Field inspection includes individual members, connections and welds. Bolted connections and field welds will be visually inspected.
C. Additional testing will be performed to determine compliance of corrected Work with specified requirements by Contractor and at no cost to the Owner.

END OF SECTION 05 05 00

05 12 00 – STRUCTURAL STEEL FRAMING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for structural steel framing.
   1. Structural steel framing members.
   2. Support members.
   3. Base plates.
   4. Bearing plates.
   5. Grouting under base plates.
   6. Fasteners and welding required for erection of structural steel provided under this section.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Shop Drawings.

1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC – Specification for Design, Fabrication and Erection of Structural Steel for Buildings including Commentary and Supplements, latest edition.

B. Perform exposed structural steel work in accordance with AISC Section 10.

PART 2 – PRODUCTS

2.01 STRUCTURAL STEEL (NOTHING HERE PRECLUDES THE REQUIREMENTS OF THE ENGINEERED DESIGN)

A. Angles, Plate and Bar: ASTM A36.

B. Wide Flange Shapes and Channels: ASTM A992 Dual Specification, Grade 50.

C. Structural Tubing: Cold Formed: ASTM A500, Grade B.

D. Pipe: ASTM A53, Grade B.

E. Bolts, Nuts, and Washers: ASTM A325, hexagonal heads and nuts.

F. Anchor Bolts: ASTM F1554. Non-headed with heavy hexagonal nuts.

G. Headed Anchor Studs: ASTM A108.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Sliding Bearing Plates: Teflon coated.

J. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength as required by the engineered design.

K. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

PART 3 – EXECUTION

3.01 PREPARATION

A. Special shop drawing requirements such as scale, camber, materials proposed, and calculations required.

3.02 INSTALLATION

A. Fabrication
   1. Fabricate structural steel in shop as much as practicable in accordance with AISC Specifications. Fabricate Architecturally Exposed Structural Steel (AESS) as defined by the current edition, AISC Code of Standard Practice, Section 1B. Use only materials smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove blemishes by grinding, or welding and grinding, prior to cleaning, treating and application of surface finishes. Repair and grind flush all back gouges. Remove weld splatter; grind weld profiles smooth.
   2. Orient seams away from view.
   3. Structural steel will be exposed to view. Do not use marker or crayon - use spray paint to mark steel. Remove all burns, mill stamps, etc. from exposed surfaces.
   4. All contact surfaces, whether bolted or welded, shall be checked for plane faces and the absence of burrs, or other obstructions to a snug fit.
   5. Continuously seal joined members by continuous welds. Grind exposed welds smooth. In exposed conditions where intermittent welds are permitted, fill between welds with plastic filler.
   6. Where priming or painting is required, complete assembly of units, including welding, before start of finishing operations.
   7. Wherever possible, welding shall be done in a flat position. On all welds, slag shall be removed immediately after every pass.
   8. Welds, deficient in dimension but not in quality, may be enlarged. Welds, deficient in quality, shall be cut out and redone.
   9. All steel-to-steel bolted connections shall be made with ASTM A325 bolts. Bolts shall be installed snug tight.
   10. Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members. Provide threaded nuts welded to framing and other specialty items. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
   11. Provide bolts and washers required for completion of field erection. Threads shall not bear on connecting steel.
   12. Install sliding bearing plates and protect against damage in accordance with manufacturer's written directions.
   13. Splice members only where indicated unless, with Structural Engineer's approval, splices not indicated would result in lower costs due to reduced shipping costs. Submit structural calculations signed by a Structural Engineer licensed by the State of Colorado for splices not indicated.
   14. Fabricate beam and plate lintels to bear minimum of eight (8) inches on each side of masonry openings. Weld plate to both sides of top or bottom flange of beam.
B. Meet requirements of AISC Specifications and Code of Standard Practice.
C. Establish permanent benchmarks necessary for accurate erection of structural steel.
D. Allow for erection loads. Install temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
E. Align and adjust various members forming a part of a complete frame or structure before fastening permanently. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

F. Install anchor bolts and other connectors required for securing structural steel to foundations and other in place work.
G. Clean bottom surface of base and bearing plates.
H. Level and plumb individual members of structure within specified AISC tolerances.
I. Provide anchors for beams bearing on masonry. Provide self-lubricating slide bearings.
J. Do not field cut or alter structural members without approval of Structural Engineer. Do not use gas cutting torches in field for correcting fabricating errors in structural framing. When gas cutting is permitted, finish sections equal to sheared appearance.
K. Should holes be required in addition to those provided in shop, provide such holes and strengthen area as required, with approval of Structural Engineer.
L. After erection, prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete. Apply by brush or spray to provide 1.5 MIL minimum dry film thickness.
M. Grout under base plates and beam bearing plates with specified grout in accordance with manufacturer's directions. Do not remove shims, but cut them flush with edge of base plates.
N. Finish
    1. Prepare structural component surfaces in accordance with SSPC standard SP-3 procedures.
    2. Thoroughly clean steel of rust or scale by blast or wire brushes. Remove oil or grease with a suitable solvent before priming.
    3. Shop prime structural steel members. Do not prime surfaces being field welded or in contact with concrete.

END OF SECTION 05 12 00

05 21 00 – STEEL JOIST FRAMING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for steel joist framin.g
  1. Open web steel joists with bridging.
  2. Attached seats.
  3. Chord extensions.
  4. Anchors.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.

1.04 QUALITY ASSURANCE
- A. Perform fabrication and erection in accordance with SJI “Standard Specifications, for Open Web Steel Joists, and Longspan Steel Joists”, latest edition.

PART 2 – PRODUCTS

2.01 PRODUCTS
- A. Design requirements including deflection, special bridging provision for ducts and chord extensions.
- B. Steel Joists
  1. Primer: VOC compliant. Performance meeting requirements of FS TT-P-664.
  2. Bearing Plates and Supplementary Framing: ASTM A36.
  3. Welding Materials: AWS D1.1; type required for materials being welded.
- C. Finish
  1. Shop prime joists. Do not prime surfaces being field welded or in contact with concrete.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Erect and bear joists on supports. Erect joists straight and with axis vertical.
- B. Allow for erection loads. Install temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing. Place bridging before joists are loaded.
- C. Bearing:
  1. Open Web Steel Joists:
     a. Masonry: Four (4) inches minimum at eight (8) inch nominal CMU walls and six (6) inches minimum at one (1) foot or greater nominal CMU walls, unless noted otherwise.
     b. Steel: Two and one-half (2½) inches minimum, unless noted otherwise.
  2. Long Span Steel Joists:
     a. Masonry: Six (6) inches minimum, unless noted otherwise.
     b. Steel: Four (4) inches minimum, unless noted otherwise.

D. Joist Anchorage to Steel:
    1. Weld steel joists to steel beams or bearing plates on both sides of joist bearing.
        a. Open Web Steel Joists: One and one-half (1½) inches minimum weld, unless noted otherwise.
        b. Long Span Steel Joists: Three (3) inches minimum weld, unless noted otherwise.
E. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

END OF SECTION 05 21 00

05 31 00 – STEEL DECKING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for steel decking.
   1. Steel roof deck and accessories.
   2. Acoustic steel deck and insulation inserts.
   3. Steel floor deck and accessories.
   4. Framing for openings up to and including one (1) foot.
   5. Provide and install custom metal closure strips to close off flutes in steel deck where partitions and other building components are installed or erected tight to underside of steel deck.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Shop Drawings.

1.04 QUALITY ASSURANCE

A. Standards
   1. Materials and installation shall conform to requirements of the Steel Deck Institute Design manual.
   2. Comply with the latest editions of the following:
      a. AISI “Specifications for the Design of Cold Formed Steel Structural Members.”
      b. AWS “Structural Welding Code.”
      c. ASTM A611 – “Structural Carbon Steel. Cold Rolled Sheet.”
      d. SDI “Design Manual for Floor and Roof Decks.”

B. Qualifications
   1. Manufacturer to be a member of Steel Deck Institute and certified by the SDI to manufacture deck.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All deck exposed to view and to remain unfinished shall be manufactured, stored at the manufacturing facility, shipped and stored on site so as to be protected from the weather and shall be installed free of all white deleterious coatings, blemishes or water spots. Deck exposed to view and to remain unfinished that is installed and does not exhibit a uniform aesthetic finish will be rejected and required to be removed at no cost to the Owner.

B. Decking shall not be overloaded during construction operations.

C. Re-fasten anchorage damaged under high wind conditions or by construction operations.

PART 2 – PRODUCTS

2.01 GENERAL

A. Specify grade of steel, coating and profiles (regular, composite, or acoustic.)

B. Specify design standard as well as any restrictions on the design such as gauge, deflection, length of sheets. Note special requirements for composite deck to receive concrete.

2.02 PRODUCTS

A. Steel Deck
   1. Deck Types: As required by the design.
   2. Sheet Steel: ASTM A653 Structural Quality having a minimum yield strength of thirty-three (33) ksi; prime painted, G90 galvanizing and on exterior canopy decks.
   3. Bearing Angles: ASTM A36 steel, unfinished.
   4. Welding Materials: AWS D1.1.
   5. Touch-Up Primer: Zinc red oxide type or as otherwise required.
   6. Flute Closures: Custom shaped metal; profiled to fit tight to decking.
   7. Acoustical Deck Insulation Inserts: Manufacturer's standard or as otherwise required.

2.03 FABRICATION

A. Fabricate to Steel Deck Institute requirements.
B. Deck Accessories: Metal closure strips (finish to match deck), wet concrete stops, cant strips, cover plates, minimum twenty (20) gauge sheet steel.
C. Sump Pan: Minimum fourteen (14) gauge sheet steel; shape to size/slope.
D. Floor Drain Pan: Minimum fourteen (14) gauge sheet steel; shape to size/slope.
E. Fasteners: Hardened steel, galvanized, self-tapping. Stainless steel on exterior canopy decks.
F. Weld Washers: Mild steel, uncoated.
G. At exterior canopy decks, and interior exposed deck not painted conditions use stainless steel screws clipped to expose no more than three-quarter (¾) inch of screw body.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Specify details of fastening, restrictions on hole cutting and paint touch-up of welds.
B. Erect metal decking in accordance with Steel Deck Institute Design Manual, latest edition.
C. Supporting members shall be completely in place before laying of deck units is undertaken. Laying and aligning of units shall be done so as to maintain the required number of units and to prevent stretching or contracting of the side laps. The decking units shall be welded to the structural supports. End laps shall occur over supports.
D. Bear decking on steel supports with one and one-half (1½) inch minimum bearing. Align and level.
E. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking and support of other work.
G. Fasten deck to steel support members at ends and intermediate supports with fusion welds through weld washers or mechanical fasteners.
H. Fasten deck side laps. Button punched side lap connections are not acceptable.
I. Verify acoustical deck insulation inserts are installed prior to placing roof sheathing and/or insulation.
J. Install six (6) inch minimum wide sheet steel cover plates of same thickness as decking, where deck changes direction. Fusion weld or mechanically attach one (1) foot o.c. maximum.
K. Cut and neatly fit deck around other work projecting through or adjacent to decking.
L. Seal joints to prevent leakage of wet concrete.
M. Install wet concrete stops at deck edge upturned to top surface of slab.
N. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
O. Position roof sump pans with flange bearing on top surface of deck. Attach at each deck flute.

P. Immediately after welding deck and other metal components in position, coat welds, weld blooms, burned areas, and damaged surface coating, with touch-up prime paint.

END OF SECTION 05 31 00

05 40 00 – COLD-FORMED METAL FRAMING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for cold-formed metal framing.
  1. Axially loaded steel studs.
  2. Exterior wall closures.
  3. Bracing, fasteners and accessories.
  4. Metal stud wall and ceiling framing for gypsum board.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.

1.04 QUALITY ASSURANCE
- A. Standards
  1. Perform Work in accordance with AISI – Cold-Formed Steel Design Manual.
- B. Qualifications
  1. Erector: Minimum three (3) years' experience in erection of cold formed metal framing for projects of similar size and complexity.
- C. Design system to accommodate three-quarter (¾) inch vertical deflection of structural building frame, live loading, seasonal, and day/night temperature ranges and construction tolerances.
- D. Tolerances
  1. Maximum Variation: One-quarter (¼) inch.
  2. Maximum Variation of Member from Plane: One-quarter (¼) inch in eight (8) feet.
  3. The aforementioned tolerances do not preclude the Installer from meeting other requirements, i.e. accessibility, egress, or similar.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. It is the intent to use framing materials manufacturer whose products are certified to contain at least twenty-five percent (25%) to one hundred percent (100%) recycled metals.

2.02 PRODUCTS
- A. Cold Formed Metal Framing
  1. Studs: ASTM C955, galvanized G60 minimum, formed to C shape, punched web. Eighteen (18) gauge thick minimum, one and five-eighths (1-5/8) inch face and six (6) inch depth, minimum yield of thirty-three thousand (33,000) psi, or as otherwise required.
  2. Track and Headers: ASTM A611, galvanized G60 minimum; channel shaped; same depth as studs. Eighteen (18) gauge minimum, solid web, minimum yield of thirty-three thousand (33,000) psi, or as otherwise required.
- B. Metal Stud Wall and Ceiling Framing for Gypsum Board

1. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel. Twenty (20) gauge studs, unless otherwise noted.
2. Furring, Framing, and Accessories: ASTM C645. GA-216 and GA-600.
3. Runners: ASTM C645, twenty (20) gauge, oversize to receive studs. Provide long leg runners for slip joint at structure.
4. Cold-Rolled Channels: Minimum sixteen (16) gauge cold rolled channels. Include furring channel clips and hanger/tie wire.
5. "Z" Furring Channels: Minimum twenty-four (24) gauge, metal furring channels.
6. Metal Furring Channels: Roll formed, hat shaped minimum twenty-five (25) gauge, channels.
7. Resilient Channels: Minimum twenty-five (25) gauge, with pre-punched four (4) inch o.c. holes.

C. Accessories
1. Bracing, Furring, Bridging, Plates, Gussets, Clips: Formed sheet steel, thickness to match studs; same finish as framing members.
2. Screws: Hot dip galvanized, self-drilling, self-tapping.
3. Anchorage Devices: ASTM B633.
4. Welding: In accordance with AWS D1.1 and AWS D1.3.
5. Primer: Touch-up for galvanized surfaces, SSPC – Paint 20.

D. Finishes
1. Galvanize to ASTM A123, G60 coating class, unless otherwise noted or required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Erection of Studs
1. Align floor and ceiling tracks; locate to wall or partition layout. Secure in place at maximum one (1) foot, four (4) inches o.c.
2. Align holes in stud walls to facilitate straight horizontal electrical conduit and piping pathways.
3. Place studs at one (1) foot, four (4) inches o.c.; not more than two (2) inches from abutting walls, and at each side of openings. Connect studs to tracks.
4. Construct corners using minimum three (3) studs. Double stud wall openings, door and window jambs.
5. Erect load bearing studs one (1) piece full length. Splicing of studs is not permitted.
6. Allow for deflection, directly below horizontal building framing for non-load bearing framing.
7. Attach cross studs to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.
8. Provide cripple studs above and below openings, at free-standing elements and wherever required to provide support. Securely attach cripple studs to supporting members.
9. Bridging: Provide stud bridging and install in a manner to provide resistance to both minor axis bending and stud rotation. Space bridging rows in accordance with manufacturers' recommendations.
10. All combined studs shall be stitch welded.
11. Partition Heights: To minimum six (6) inches above suspended ceilings, unless noted otherwise.
12. Install additional bracing for partitions extending above ceiling at maximum four (4) feet o.c.
13. Where stud framing extends to structure above, maintain clearance to avoid deflection transfer to studs with extended leg ceiling runners.

14. Where stud walls are constructed on slabs on grade, do not connect stud walls to exterior walls located on independent foundations.
15. Double twenty (20) gauge, studs are required at jambs of openings and at corners and partition intersections.
16. Compress sill sealer behind studs at junctions with masonry walls.
17. Shaft Wall Framing: Install to meet the required fire resistance rating.
18. Secure steel channel blocking to framing for support of casework, plumbing fixtures, chalkboards/tackboards, hardware, toilet room accessories and other wall and ceiling mounted equipment. Coordinate exact locations with other trades.

B. Wall Furring
1. Erect metal furring stud framing tight to concrete masonry walls; attached by adjustable furring brackets. Erect vertically.
2. Space furring maximum one (1) foot, four (4) inches o.c.
3. Install furring as required for fire resistance ratings indicated.

C. Ceiling Framing
1. Install in accordance with ASTM C754 and GA-216.
2. Install minimum twenty (20) gauge studs with intermediate supports to limit deflections to one- three hundred-sixtieth (1/360) of the span.
3. Coordinate location of hangers with other work. Install ceiling framing independent of walls, columns, and above ceiling work. Brace to maintain lines, shape and level ceiling.
4. Reinforce openings in ceiling suspension system interrupting main carrying channels or furring channels with lateral channel bracing.
5. Laterally brace entire suspension system.
6. Coordinate soffit framing members with light fixture pattern.
7. Reinforce openings in ceiling suspension system interrupting main carrying channels or furring channels with lateral channel bracing.

D. Miscellaneous Framing
1. Provide necessary framing and furring for special framing at recesses, specialty items, etc. Frame around columns. Provide necessary framing and suspension for offsets, verticals, recessed and all other gypsum drywall surfaces.

E. Field Touch-Up
1. Touch-up field welds and damaged prefinished surfaces with galvanized primer.

END OF SECTION 05 40 00

05 50 00 – METAL FABRICATIONS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for metal fabrications.
   1. Shop fabricated metal items.
      a. Lintels, angles, channels, tubes.
      b. Plate steel fabrications.
   2. Steel stairs/landings.
   3. Metal railings, guardrails, and wall brackets.
   4. Bollards.
   5. Framing for mechanical openings/penetrations.
   6. Operable wall and accordion partition support beams/bolts.
   7. Decorative metal.
   8. Finished wall panels.
   9. Elevator support steel and hoist beam.
   10. Solar screens.
   11. Trash enclosure.
   12. Wall expansion joint covers.
   13. Support steel for tv brackets.
   14. Roof ladders and roof hatch access ladders.
   15. Clip angles for attachment of internal wood frames at windows.
   16. Metal back-box at shower valve.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 DEFINITIONS

A. Design stair assembly to support live load as required by project.

B. Design handrails and attachments to resist lateral forces as required by the appropriate code.

1.04 SUBMITTALS REQUIRED

A. Shop Drawings.

B. Samples.

1.05 QUALITY ASSURANCE

A. Standards
   1. Conform to requirements of American Institute of Steel Construction (AISC): Code of Standard Practice for Steel Buildings and Bridges.
   2. Conform to Code of Standard Practice for the Architectural Metals Industry AMO-555-92 and Voluntary Finish Standards by National Ornamental and Miscellaneous Metals Association (NOMMA).

B. Qualifications
   1. Fabricator: Firm experienced in successfully producing metal fabrications with sufficient production capacity to produce required units without causing delay in the Work.

C. Metal Surfaces: Use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, roughness and steel sheet variations in flatness not exceeding those permitted by referenced standards.
D. Specify materials, component sizes, gauges of metals, anchorage and a fastening that shall withstand the intended use within allowable design factors, as required by all applicable codes and standards. Specify that all work is free of warping, buckling, opening of joints and seams, distortion and permanent deformation.
E. The fabricator shall design the details of the railing and stairs, and the connections to the building structure, to satisfy the requirements of all applicable codes and standards, and shall provide copies of the shop drawings and calculations stamped by a licensed Professional Engineer in the State of Colorado.

PART 2 – PRODUCTS

2.01 METAL FABRICATIONS (NOTHING HERE PRECLUDES THE REQUIREMENTS OF THE ENGINEERED DESIGN)
A. Steel Sections: ASTM A36/A36M.
B. Steel Plate: ASTM A283.
C. Steel Tubing: ASTM A500, Grade B.
D. Steel Pipe: ASTM A53, Grade B. Pipe shall be standard weight with black finish unless otherwise noted.
E. Sheet Steel: ASTM A653/A653M, Grade B structural quality.
F. Decorative Metals:
1. Galvanized Sheet Steel: Minimum twenty (20) gauge.
2. Galvanized, Corrugated Sheet Steel: Minimum twenty-five (25) gauge.

2.02 ACCESSORIES
A. Welding Materials: AWS D1.1.
B. Fasteners: Appropriate for substrates being anchored to and of adequate size to provide a permanently rigid and secure installation.
1. Finish for Exterior Use: Zinc coated, ASTM A153.
C. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
D. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic.
E. Non-Metallic Non-Shrink Grout: Pre-mixed, non-shrinking, non-staining, non-metallic, non-corrosive, non-gaseous grout.

2.03 FABRICATION
A. General:
1. Fit and shop assemble items in largest practical sections, for delivery to site. Where field joints are required, completely assemble work in shop to ensure accurate fit and disassemble for shipment.
2. Continuously seal joined members by continuous welds. Use welded connections wherever possible. Locate welds in least conspicuous location. Perform welding in accordance with AWS requirements.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
4. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
5. Exposed Mechanical Fastenings: Avoid using mechanical fasteners where possible. When necessary, use flush countersunk screws or bolts, consistent with design of component.

Mechanical connections shall be adequate to develop the full strength of the members being framed together. Nick threads of screws and bolts to prevent loosening.

6. Cut, reinforce, drill and tap miscellaneous metal work to receive finish hardware and similar items.
7. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication.
8. Connection and accessories shall be adequate to withstand loads and stresses.

B. Pan Stairs And Landings:
   1. Fabricate stairs and landings with closed risers and treads of metal pan construction, ready to receive concrete.
   2. Provide intermediate support of treads and risers so unsupported span does not exceed three (3) feet, six (6) inches. Provide intermediate support at landings so the unsupported span does not exceed two (2) feet.
   3. Secure tread pans to stringers; weld in place.

C. Handrails:
   1. Fit and shop assemble components in largest practical sizes, for delivery to site.
   2. Grind exposed joints flush and smooth with adjacent finish surface.
   3. Accurately form components to fit stairs and landings, to each other and to building structure.
   4. Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.
   5. Close ends of handrails and return to wall. Provide appropriate malleable iron handrail brackets for pipe handrails where the use of handrail brackets is noted.
   6. Paint interior railings formed from steel pipe with shop primer. Provide ferrous metal fittings, brackets, fasteners and sleeves.
   7. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.
   8. Fabricate handrails from one and one-quarter (1¼) inch NPS round pipe unless noted otherwise.
   9. Exterior Railings: Galvanize railing and components or provide stainless steel.

D. Pipe Bollards:
   1. Schedule 80 galvanized steel pipe sections for filling with concrete.

E. Secondary Framing:
   1. Fabricate secondary steel framing supports for ceiling hung equipment including operable walls and accordion partitions.

F. Ladders:
   1. Comply with the requirements of all applicable codes and standards.

2.04 FINISHES

A. Prepare surfaces to be primed in accordance with project requirements.
B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
C. Shop prime interior items with one coat. Do not prime surfaces in direct contact with concrete or where field welding is required.
D. Spray-apply shop primer paint to items exposed to view. Provide dry paint film thickness of two (2) MILs minimum.
E. Sheet steel finish panels shall be G90 coated galvanized steel of lock-forming grade, in accordance with ASTM standards A525 and A527, mill phosphatized.

F. All exterior steel, except lintels, to be galvanized; all interior steel to be prime painted, unless noted otherwise.

PART 3 – EXECUTION

3.01 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates.
C. Protect surfaces in contact with cementitious materials and dissimilar materials with bituminous paint or membrane matching miscellaneous metal finish. Allow to dry prior to installation.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Perform field welding in accordance with AWS D1.1.
D. Obtain approval prior to site cutting or making adjustments not scheduled.
E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION 05 50 00

05 58 00 – FORMED METAL FABRICATIONS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for formed metal fabrications.
  1. Sheet metal fabrications including the following:
     a. Steel countertops.
     b. Steel wall and wainscot panels.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.

1.04 QUALITY ASSURANCE
- A. Manufacturer: Firm which employs skilled persons and which has successfully fabricated products similar to those required for this Project and which has sufficient capacity to produce required units without causing delay in the Work.
- B. Field Measurements: Verify size, location, and placement of sheet metal fabrications with adjoining construction prior to fabrication.

PART 2 – PRODUCTS

2.01 MANUFACTURERS AND FABRICATORS
- A. Single Source Responsibility: Obtain sheet metal fabrications from a single manufacturer or fabricator.

2.02 PRODUCTS
- A. Sheet Metals:
  1. Provide sheet metals selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, stains, discoloration or other imperfections.
- B. Miscellaneous Materials:
  1. Welding Electrodes and Filler Metal:
     a. Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for strength and compatibility in the fabricated items.
     b. Use filler metals and welding procedures which will blend with and match the color of sheet metal being joined and will avoid discoloration at welds.
  2. Fasteners:
     a. Of same basic metal and alloy as fastened metal. Do not use metals which are corrosive or incompatible with metals joined.

b. Provide concealed fasteners for interconnection of sheet metal fabrications and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method.

C. Fabrication:
1. Coordinate dimensions and attachment methods of sheet metal fabrications with those of adjoining products and construction to produce integrated assemblies with closely fitting joints, and edges and surfaces aligned with one another.
2. Increase metal thickness or reinforce metal with concealed stiffeners or backing materials or both as required to produce surfaces whose variations in flatness exceed those permitted by referenced standards for stretcher-leveled metal sheet and to impart sufficient strength.
3. Preassemble sheet metal fabrications in the shop to the greatest extent possible to minimize field splicing and assembly.
4. Form sheet metal fabrications to profiles indicated in maximum lengths to minimize joints and without exposed cut edges.
5. Continuously weld all joints and seams; grind, fill, and dress welds to produce smooth flush exposed surfaces in which welds are invisible after final finishing is completed.
6. Build-in straps, plates and brackets as required for support and anchorage of fabricated items to adjoining construction; reinforce sheet metal units as required for attachment and support of other construction.

D. Wall and Wainscot Panels:
1. Incorporate trim, and exposed anchorages for attachment to adjacent surfaces.
2. Panels and trim shall have no sharp edges or corners. Panels and trim shall be adequately secured so as not to be bent, presenting a hazard.

E. Countertops:
1. Fabricate metal countertops by forming and welding to provide seamless construction, using welding rods matching sheet metal, grinding and polishing. Where necessary for disassembly, provide waterproof gasketed draw-type joints with concealed bolting.
2. Field Joints:
a. For any field joint required because of size of countertop, butt-joint, reinforce on underside with angles of same material, bolt together with non-corrosive bolts and nuts, field weld, grind and polish.
3. Workmanship:
a. Field verify dimensions, check measurements before fabricating; conform all items to dimensions of building; neatly fit around offsets and other obstructions.

F. Finishes, General:
1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Locate and place sheet metal fabrications plumb, level and in alignment with adjacent construction.
B. Use concealed anchorages where possible for countertops.
C. Form tight joints with exposed connections accurately fitted together.

END OF SECTION 05 58 00

DIVISION 06: Wood, Plastics, and Composites

06 05 00 – COMMON WORK RESULTS FOR WOOD, PLASTICS, AND COMPOSITES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for wood, plastics, and composites. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SAMPLES

A. Actual physical samples for any product requiring a color or finish selection must be provided.

PART 2 – EXECUTION (NOT USED)

PART 3 – PRODUCTS (NOT USED)

END OF SECTION 06 05 00

06 10 00 – ROUGH CARPENTRY

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for rough carpentry.
   1. Miscellaneous structural framing and blocking.
   2. Fire treated plywood wall sheathing, back boards, and in-wall blocking.
   3. Blocking in parapet cap and gravel stop construction.
   4. Blocking at operable and accordion door supports.
   5. Concealed blocking for support of wall mounted equipment, including but limited to: handrails and guardrails, door stops and hold opens, grab bars, architectural specialties, plumbing fixtures, toilet accessories, wall mounted devices, and specialties, wall lighting, casework and shelving, and any other surface mounted items as required for proper anchorage. Metal strip backing is prohibited, fire treated ¾-inch plywood or lumber blocking at all mounting locations.
   6. Furring and grounds.
   7. Wood preservative treatment.
   8. Fire treatment.
   9. Wood curbs for roof-mounted equipment.
   10. Wood window bucks (fire and pressure treated) for attachment of window frame to framing.
   11. Plywood backing at all walls scheduled to receive shelving on standards and brackets.
   12. Wood decking.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Product Data

B. Samples:
   1. Manufacturer’s information on wood preservative materials.
   2. Manufacturer’s information on fire retardant materials.
   3. Submit manufacturer's certificate certifying products conform to specified requirements.

1.04 QUALITY ASSURANCE

A. Lumber Grading: Comply with Grading Rules for Western Lumber published by Western Wood Products Associations; Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing and mill. Certified by AITC 108.

B. Plywood Grading Agency: Certified by APA/EWA – American Plywood Association/The Engineered Wood Association. Identify each piece with APA Grade Trademark.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect sheathing from moisture which will cause delamination, or deterioration of properties, during storage, after erection and prior to installation of weather protection.

PART 2 – PRODUCTS

2.01 LUMBER MATERIALS

A. Lumber Grading Rules: WWPA.
B. Non-Structural Light Framing: Hem Fir, Douglas Fir-Larch species, No. 2 grade or better, nineteen percent (19%) maximum moisture content.
C. Blocking and Furring: Stress group A, Hem Fir, Douglas Fir species, No. 2 grade or better grade, 19 percent (19%) maximum moisture content.

2.02 PLYWOOD SHEATHING

A. Plywood APA/EWA Rated Sheathing Structural I, plywood, Span Rating 32/16; Exposure Durability one (1); unsanded, one-half (½) inch-thick, fire treated.

2.03 WALL SHEATHING MATERIALS

A. Oriented Strand Board set with waterproof resin binder; unsanded faces. Thickness: one-half (½) inch.

2.04 MISCELLANEOUS PLYWOOD USES

A. Telephone and Electrical Panel Boards: Fire-Treated Plywood, APA/EWA Structural II, sanded; thickness three-quarter (¾) inch.

2.05 WOOD DECKING

A. Two (2) inches by six (6) inches tongue and groove.

2.06 PREFABRICATED TIMBER TRUSSES

A. Trusses shall be designed by an Engineer engaged by the supplier and fabricated to safely carry the loads shown on the drawings.
B. Shop drawings shall be signed and stamped by the supplier's Design Engineer. They shall clearly indicate material grades, connectors, temporary and permanent bridging and connections to the framing.
C. Submit for review, brochures indicating wood connectors and fasteners proposed to connect structural members. If requested, submit samples of connectors together with structural calculations and/or test results with respect to load capacity of each type of connector.
D. Where exposed, fabricate trusses with particular regard to appearance. Connectors must be placed square and without unnecessary overhangs, and shall be visually in keeping with the character of the building. Splices are to be made accurately and chord members straight and parallel. Wood members shall be chosen for appearance with a minimum of small knots. Kiln dry all material.

2.07 BOLTS, ANCHORS, CONNECTORS

A. Fasteners: Hot dipped galvanized steel for exterior, high humidity, and treated wood locations, plain finish elsewhere.
B. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.08 EXTERIOR WOODWOOK

A. Avoid the use of exterior woodwork and timber, substituting materials of great longevity wherever possible such as pre-cast concrete units for retaining walls, painted steel for trellises, metal cladding for building walls, etc.
B. When used, all exposed wood is to be quality cedar or redwood and/or quality material pressure treated with an environmentally friendly preservative. Structural and aesthetic qualities which determine wood type are still applicable despite preservative treatment. Material must be sufficiently "cured" before using where direct contact with plant materials is likely.
C. Use paint or stain, if necessary, of a type compatible to preservative material as recommended by manufacturer to prevent non-adhesion and/or blistering.

2.09 WOOD TREATMENT

A. Pressure treat the following with wood preservative: AWPA Treatment C1 water borne preservative with a minimum retention of 0.25 pcf.

1. Roof blocking, plates, cants, nailers, curbs, equipment support bases, stripping and framing in contact with roofing membrane.
2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than one (1) foot, six (6) inches above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

B. Pressure treat wood members in contact with ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.
C. Complete fabrication of treated items prior to treatment where possible. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
D. Pentachlorophenol or Creosote is not acceptable.
E. Products containing chromium or arsenic a should be avoided.
F. Fire Retardant Treatment:
    1. Pressure treat with Class A fire retardant and preservative intended for wood.
    2. Fire-retardant-treated wood products that are free of halogens, sulfates, ammonium phosphate and formaldehyde.
    3. Required for lumber and plywood at following locations:
        a. Exterior and bearing walls.
        b. Roofs.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide curbs at skylights.
B. Blocking for roofing system. Secure roof blocking to resist wind loading of seventy-five (75) pounds per lineal foot or to resist wind loading specified for the roofing system, whichever is greater.
C. Provide treated two (2) by ten (10) continuous around interior of trash enclosure perimeter at trash container lid height.
D. Decking
    1. Install decking perpendicular to framing members, with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward.
    2. Fit butt end deck joints occurring between support members with metal splines to maintain tight, aligned joints.
    3. Engage decking tongue and groove edges.
    4. Attach decking with screws. Fasteners shall be “blind” and concealed in the tongue and groove connection. No exposed fasteners allowed.
    5. Maintain decking joint space of one-sixteenth (1/16) inch maximum.
    6. Tolerances: Surface flatness of decking without load: One-quarter (¼) inch in ten (10) feet maximum, and one-half (½) inch in thirty (30) feet maximum.
E. Sheathing
    1. Secure wall sheathing with ends staggered, over firm bearing. Screw to studs.
    2. Install plywood telephone and electrical panel back boards of sizes. Install with grade stamp/label exposed to view. Do not paint.
F. Site Applied Wood Treatment
    1. Treat site-sawn cuts. Brush apply two coats of preservative treatment on untreated wood in contact with cementitious materials, roofing and related metal flashings.
    2. Allow preservative to cure prior to erecting members.

END OF SECTION 06 10 00

06 20 00 – FINISH CARPENTRY

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for finish carpentry.
   1. Interior finish carpentry work.
   2. Wood moldings and trim.
   3. Millwork: Custom fabricated plastic laminate faced plywood, wood cabinet units, hardware and accessories.
   4. Plastic laminate faced countertops
   5. Utility shelving.
   6. Exterior gates.
   7. Custom display cases.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 RELATED SECTIONS

A. 06 60 00 – Plastic Fabrications.

B. 12 30 00 – Casework.

1.04 SUBMITTALS REQUIRED

A. Shop Drawings.

B. Product Data.

C. Samples.

1.05 QUALITY ASSURANCE

A. All architectural millwork to meet AWI Custom Grade.

B. Structural Integrity:
   1. Shelves, including wall cabinet tops and bottom shelves, shall be designed to support twenty (20) pounds per linear foot, with no apparent deflection.
   2. Counter tops shall be designed to safely support loads of two hundred (200) pounds concentrated on one (1) square foot in any area with no apparent deflection.
   3. The maximum span between brackets/supports for shelf material shall be one (1) foot, four (4) inches.
   4. Provide appropriate anchorage into substrate to carry design loads. In-wall blocking is required.

C. Every cabinet panel shall be fabricated with plastic laminate material on both faces or a balancing sheet on concealed faces.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. All millwork shall be furnished and installed by one manufacturer and shall be unform in detail for all units.

2.02 LUMBER MATERIALS

A. Softwood: PS 20; Idaho White Pine species, plain sawn, maximum moisture content of six percent (6%); with vertical grain of quality suitable for transparent finish.
B. Hardwood Lumber: Maximum moisture content of six percent (6%); with vertical plain sawn grain of quality suitable for transparent finish.
C. Straw Board (Rye Grass Material): Three-eighths (3/8) inch-thick.

2.03 RECLAIMED WOOD/PLASTIC COMPOSITE MATERIAL

A. Material for Exterior Gates: Provide two (2) foot by six (6) foot planks, non-fading, ninety-five percent (95%) recycled plastic film and reclaimed wood.

2.04 SHEET MATERIALS

A. Particle Board: Medium density (forty-five to fifty (45 to 50) pounds per cubic foot) ANSI A208.1, Grade 1-M-1, wood chip and phenolic resin binders, compressed board, 0.75-inch thickness, unless otherwise noted. Minimum screw holding capacity: faces: Two hundred-twenty-five (225) pounds; edges two hundred (200) pounds. Moisture resistant particle board shall be used in casework and countertops with sinks. No added urea-formaldehyde resins allowed.
B. Hardboard: PS 58, Class I (tempered), smooth one side or both sides. 0.25-inch thickness unless noted otherwise.
C. Polyester Laminate Particle Board: Thermofused polyester/melamine resin impregnated overlay bonded to minimum forty-five (45) pound density particle board. Particle board shall be of balanced construction with a maximum moisture content of eight percent (8%). Particle board shall meet Commercial Standard CS236-66 and Federal Specification LLL-B-800A. Polyester laminate shall be nine to eleven (9 to 11) millimeters in thickness, sixty-two percent (62%) resin content, colorfast and shall meet or exceed ASTM D-L-300 and NEMA Test LSI-2.06.

2.05 HIGH DENSITY DECORATIVE PLASTIC LAMINATE

A. Plastic Laminate: Comply with NEMA LD3. All plastic laminate components shall be finished with backing sheets meeting LD-3 BK20, where not finished both sides with plastic laminate sheets. Use GP-50, colors, patterns and finishes. Manufacturer to use water based phenolic and melamine resins. Wood in laminate filler paper to be from non-rainforest timber. Laminate shall be free of chemicals on EPA reduction list.
B. Plastic Laminate Finished Surfaces: Conform to the following Plastic Laminate Materials:
    1. Plastic Laminate for Horizontal Surfaces: GP-50 (0.050-inches nominal thickness).
    2. Plastic Laminate for External Vertical Surfaces, Open Shelves and Cabinet Interiors Without Doors: GP-28 (0.028-inches nominal thickness).
    3. Plastic Laminate for Post Formed Surfaces: PF-42 (0.042-inches nominal thickness).
    4. Plastic Laminate for Cabinet Linings: CL-20 (0.020-inches nominal thickness).
    5. Plastic Laminate for Concealed Panel Backing: BK-20 (0.020-inches nominal thickness).
    6. Fabricate exposed edges of doors and drawers with three (3) millimeter PVC edge with all edges and corners radiused.
    7. Fabricate exposed edges of cabinet boxes with one (1) millimeter PVC applied with hot melt glue.
    8. Fabricate exposed edges of back/side splash with plastic laminate to match countertop.

2.06 GLASS

A. Display Case Shelves: Three-eighths (3/8) inch clear tempered with rounded front and back edges.
B. Custom Display Case Doors: Three-eighths (3/8) inch clear tempered or one-quarter (¼) inch laminated. Provide bumper protection.

2.07 ADHESIVE

A. Adhesive: Recommended by AWI to suit application. Must comply with VOC and chemical limits.

2.08 HARDWARE

A. Hinges: One hundred-twenty (120) degree straight arm, self-closing concealed hinge. Three (3) hinges for doors over four (4) feet high.
B. Pulls: Four (4) inch wire pull.
C. Drawer Slides: One hundred (100) pound load bearing. Full extension, provide file drawers with built-in file folder supports.
    1. Swinging Glass Door Hinges: Pivot hinges, brass with satin chrome finish.
D. Locks:
E. Shelf Supports: Metal shelf supports for one-quarter (¼) inch holes, minimum four (4) per shelf.
F. Standards and Brackets: Super duty steel, single slot design with two (2) inch vertical slot adjustability. Load capacity: Up to one thousand-sixty (1060) pounds per pair. Seven-ninety-eighths (7/98) inch wide, eleven-sixteenth (11/16) inch deep, with associated accessories to secure shelves to brackets.
G. Pencil Drawers: Pre-fabricated undermount desk drawer with two drawer bearers, two (2) inch-high by sixteen (16) inches +/- wide by twenty-one (21) inches +/- deep.
H. Grommets: 2.5-inch, one (1) per workstations—field locate.
I. Door Stops: Overhead, opening, with shock absorber. Finish: US26.
J. Keyboard Tray: Keyboard arm with keyboard platform clamp, height and tilt adjustment. Three hundred-sixty (360) degree arm swivel rotation, seventeen (17) inch track with twelve (12) +/- travel, steel with black power coat.
K. Pocket Door Hardware: Steel ball bearings.
L. Display Case Hardware: Aluminum track system for sliding glass door installations, anodized aluminum finish, all accessories required for a complete assembly. Provide adjustable ratchet lock.
M. Label Holders: Three-quarter (¾) inch x two and one-half (2½) inch, mechanically fastened.

2.09 ACCESSORIES

A. Primer: Alkyd primer sealer type, low VOC content.
B. Wood Filler: Solvent base, tinted to match surface finish color.
C. Brackets for Countertops: Exposed bracket with wire passage. One-eighth (1/8) inch steel, powder coated finish.

2.10 CASEWORK FABRICATION

A. Field verify all conditions and dimensions before beginning any fabrication.
B. Pre-Cut Openings: Fabricate custom casework with pre-cut openings wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Smooth edges of cutouts and, where located in counter tops and similar exposures, seal the edges of cutouts with a water-resistant coating. Corners of cutouts shall be rounded.
C. Cabinet Design: Flush overlay design with three (3) millimeter PVC on edges of drawers and doors. Provide tight radius on corners of PVC.
D. Cabinet Bodies:
    1. Sub-Base:
        a. Provide cabinets supported on floor with a separate continuous wood sub-base which supports cabinets.
        b. Sub-base shall consist of three-quarter (¾) inch-thick exterior grade unfinished fir plywood.
            i. Option: adjustable support legs and one-quarter (¼) inch hardboard backing closure for rubber base, by others.
        c. At exposed ends of cabinets, hold plywood sub-base back one-eighth (1/8) inch from face of cabinet creating a one-eighth (1/8) inch-deep recess to receive one-eighth (1/8) inch-thick vinyl base, by others.

2. Construction:
    a. Core material for plastic laminate cabinet tops, bottoms and sides shall be minimum three-quarter (¾) inch-thick medium density particle board.
    b. No wood edgebanding on any countertop, unless matching existing conditions.
3. Cabinet Backs:
    a. Backs shall be no less than three-eighth (3/8) inch-thick particle board prefinished to match interior of cabinet.
    b. Manufacturer has option to provide a solid three-quarter (¾) inch-thick back, which is secured to top, bottom and sides of cabinet with glue, dowels and screws in lieu of routing back into cabinet construction.
4. Door and Drawer Fronts:
    a. Core material for plastic laminate door and drawer fronts shall be minimum three-quarter (¾) inch-thick particle board.
    b. High density plastic laminate exterior and thermofused polyester/melamine exposed interior face for plastic laminate cabinets.
    c. Edge bound with three (3) millimeter PVC in color to match exterior surface.
5. Drawer Construction:
    a. Drawer fronts to be applied to drawer sub-front.
    b. Drawer bodies for plastic laminate cabinets shall be solid hardwood, laminated covered plywood or polyester laminated fiberboard.
6. Shelving:
    a. Shelves behind doors of plastic laminate cabinets shall be thermofused polyester/melamine laminated particle board two sides, three-quarter (¾) thick.
    b. Open shelving of plastic laminate cabinets shall be particle board laminated with high density plastic laminate both sides.
    c. Leading exposed edge of shelves of plastic laminate cabinets behind doors shall be edged with one (1) millimeter PVC, in color to match shelves.
    d. Edges of open shelving of plastic laminate cabinets shall be edged with high density plastic laminate, in color to match plastic laminate on face of shelves.
        i. Shelving core thickness of plastic laminate cabinets shall meet design load requirements herein. Three-quarter (¾) inch-thick, one and one-quarter (1¼) inch minimum thickness if shelf is over thirty (30) inches in length.
7. Cabinet Finish:
    a. Exposed Exterior Surfaces of Plastic Laminate Cabinets: Cover external exposed surfaces, except counter tops, with GP28 high density plastic laminate. Surfaces shall include the underside of wall cabinets, top of cabinets which are seven (7) feet or lower from floor, and both faces and back of open shelving.
    b. Semi-Exposed Interior Surfaces of Plastic Laminate Cabinets: Cover internal semi-exposed surfaces, including cabinet interiors behind doors, drawer interiors, and shelving behind doors, with thermofused polyester/melamine laminate particle board.
    c. Unexposed Surfaces: Cover areas unexposed to view before cabinet work is installed, including concealed cabinet backs, bases and wall ends, with a backing sheet to provide balanced construction and ensure against warpage and delamination.
    d. Laminate with a Directional Pattern, Wood Grain or Linear: All pattern to run in the same direction.
8. Access Panels:
    a. Provide access panels in backs of casework where required for access to Mechanical and Electrical work. Access panels shall be minimum one (1) foot by one (1) foot and hinged.

Provide access panels at cleanouts, valves, junction boxes and other mechanical and electrical components. Verify field conditions.

2.11 PLASTIC LAMINATE COUNTERTOP FABRICATION

A. Core: Particle board, one and one-quarter (1¼) inch thick minimum; moisture resistant in counter tops with sinks. Solid surface material preferred with sink installation (not laminated material).
B. Edge: Edges to be three (3) millimeter PVC, color to match countertop.
C. Cutouts: Provide cutouts in counter tops for built-in fixtures, sinks and equipment. A minimum of two (2) inches of countertop must be left around the entire perimeter to support and secure inserts.
    1. Backsplash/Sidesplash: Provide plastic laminate counter tops with a four (4) inch high backsplash, unless noted otherwise. Provide an endsplash/sidesplash at ends of cabinet counter tops where a countertop abuts a vertical surface, including at wall or adjacent tall cabinets. Backsplash and endsplash joints shall be neat, tight, and inconspicuous and sealed with clear silicone sealant. Edges and surface to be plastic laminate to match countertop.
D. Finish: Cover countertops with GP50 plastic laminate. Adhere plastic laminate to core by hot-press method. Cold press method with PVA glue is an acceptable alternative. Provide a balancing backer sheet on underside of countertops.

2.12 UTILITY SHELVING FABRICATION

A. For adjustable shelves drill vertical members on one (1) inch centers to fit metal shelf supports.

2.13 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.
B. Apply wood filler in exposed nail and screw indentations.
C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
D. Seal internal surfaces and semi-concealed surfaces. Brush-apply only.
E. Seal surfaces on contact with cementitious materials.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Set and secure casework in place rigid, plum, true, level and straight with no distortions. Shim as required, using concealed shims. Attach all shelving to side supports/brackets for stability.
B. Use countersunk, concealed joint fasteners and blind nailing to align and secure adjoining cabinet units and counter tops. Provide concealed mechanical clamping of joints; assuring tight, level countertop joints. Anchor counter tops securely.
C. Carefully scribe and cut casework to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts. Use filler strips for this purpose, not additional overlay trim. Top and bottom filler pieces required for all scribes.
D. Secure bases to floor using appropriate anchorage.
E. Apply clear sealant between countertop/splashes and adjacent wall.
F. Adjust moving or operating parts to function smoothly and correctly. Adjust cabinet doors and drawer fronts to be level and plumb with balanced revels.
G. Backsplashes and end splashes are required in tops scheduled to receive sink.

END OF SECTION 06 20 00

06 60 00 – PLASTIC FABRICATIONS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for plastic fabrications. Additional requirements may be included within specific agreements or other contracting documents.
- B. Solid polymer fabrications fabricated from synthetic polymers and solid plastics.

1.03 RELATED SECTIONS
- A. 06 20 00 – Finish Carpentry.

1.04 QUALITY ASSURANCE
- A. Engage a fabricator who has successfully completed fabrications of the type required for this project and who has been continuously engaged in this type of work for not less than three years. Arrange for installation by the same firm as fabricated the material for sole source responsibility.
- B. Field measure prior to preparation of shop drawings and fabrication to ensure proper fitting of the work. Otherwise, indicate field measurements on final shop drawings.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver solid polymer fabrications and accessories, until wet work, grinding and similar operations which could damage, soil or deteriorate fabrications has been completed in installation areas. If, due to unforeseen circumstances, fabrications must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.06 REGULATORY REQUIREMENTS
- A. Conditioning: Be aware of temperature requirements for solid polymer fabrication installation areas.
- B. Do not install solid polymer fabrications until the required temperature has been stabilized and will be maintained in installation areas.

PART 2 – PRODUCTS

2.01 MATERIALS
- A. Solid Surface:
  1. A homogeneous, fully densified, filled polyester or epoxy resin with binders, mineral filler and pigments. Furnish in 0.5-inch-thickness.

2.02 FABRICATION
- A. General:
  1. Field verify conditions and dimensions before fabrication. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of solid polymer fabrications for accurate fit.
  2. Fabricate from single piece material except where required length exceeds maximum length available from the manufacturer. Locate joints at even intervals through the material, aligned with other adjacent joints. Form joints using manufacturer's recommended adhesives for smooth even appearance of matching color for inconspicuous appearance. Provide joints which are of an equal or greater strength than material being joined.

3. Edges: provide eased, chamfered or rounded edges at countertops and sills.
4. Window Sills: Where joints are required, locate joints at opening centers or at window mullions.
5. Provide solid surface countertops at all restrooms where countertop occurs.
6. Provide solid surface at countertops with sinks when approved by Owner.
7. Countertops to be one-half (½) inch material with built up edge, one (1) inch to one and one-half (1½) inch thickness, joined with inconspicuous seam.
8. All window sills to be solid surface, one-half (½) inch with a built-up edge to one (1) inch thickness, joined with inconspicuous seam.
9. Horizontal surfaces and back/side splashes to be one-half (½) inch thick.

PART 3 – EXECUTION

3.01 INSTALLATON

A. General
   1. Install the work plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Install to a tolerance of 0.125 inch in eighty-three (83) feet for plumb and level; and with one-thirty-second (1/32) inch maximum offsets in revealed adjoining surfaces.
   2. Scribe and cut work to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

B. Anchorage
   1. Anchor fabrications to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with concealed fasteners as required for a complete installation.
   2. Anchor to substrate with non-staining adhesive as recommended by both plastic and adhesive manufacturers. Cut and trim to fit with joints only at approved locations. Make joints one-eighth (1/8) inch to one-sixteenth (1/16) inch uniform widths and fill with color matching acrylic sealant.

3.02 CLEANING AND PROTECTION

A. Repair damaged and defective fabrications wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace fabrications.

END OF SECTION 06 60 00

DIVISION 07: Thermal and Moisture Protection

07 05 00 – COMMON WORK RESULTS FOR THERMAL AND MOISTURE PROTECTION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for thermal and moisture protection. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Mock-up/sample of waterproofing and air-water barrier joint detail.
B. All thermal and moisture protection product information.
C. Sealants.
D. Closeout Submittals: Maintenance data, and special warranty.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. Utilize light colored/high albedo materials with a high SRI for roofing material, when feasible. Color shall be light grey or tan when available.
   1. Steep-sloped roofs should have a minimum SRI of 29, while low-slope roofs should have a minimum SRI of 78.
   2. Poly Vinyl roofing is preferred in new construction. Maximize use where applicable.
   3. All installed roofing systems must be Energy Star labeled.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Building envelope should not have excessive penetrations so as to minimize the chance of water intrusion. Mechanical drainage planes opposed to caulking is preferred.
B. Stormwater Protection:
   1. Scuppers, downspouts and overflow drains shall not be installed in such a manner as to allow the water to run down the face of the building wall or across sidewalks.
   2. All roofs shall have positive slopes to drains.
   3. All new construction to have forty-two (42) inch parapet walls (preferred) or engineered fall protection system as approved by Owner.
   4. If a roof exists without proper parapets, tie offs must be provided as per OSHA 1926.502(d).
C. Sealants shall match adjacent surfaces.
D. Roof Moisture Survey: Conduct on re-roof projects not requiring tear-off.

END OF SECTION 07 05 00

07 10 00 – DAMP-PROOFING AND WATERPROOFING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for damp-proofing and waterproofing.
  1. Modified bitumen sheet membrane waterproofing.
  2. Fabric reinforcement.
  3. Protective cover drainage panel.
  4. Confirm with soil investigation report the need to use damp-proofing or waterproofing
  5. Damp-proofing: Specify emulsified mineral colloid type, unfilled.
  6. Damp-Proofing: Apply to exterior side of foundations against earth.
  7. Waterproofing: Use either rubberized asphalt waterproofing or asphalt emulsion type including primer together with coated glass cloth membrane.
  8. Waterproofing: Use insulation as a protection board where feasible.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Manufacturer's Installation Instructions.

1.04 QUALITY ASSURANCE
- A. Standards
  1. Perform Work in accordance with National Roofing Contractors Association (NRCA) - Waterproofing Manual.
- B. Qualifications
  1. Applicator: Company specializing in waterproofing systems with five (5) years minimum experience. Application to be performed only by skilled applicators who are trained and experienced in the application of specified products. A job foreman or supervisor who is experienced in the application of the product shall be on site whenever application is occurring.
- C. Warranty
  1. Provide five (5) year written warranty (from the date of substantial completion) to repair or replace defective materials and workmanship, for materials failing to resist penetration of or provide repellency of water. Include responsibility for removal and replacement of other work which conceals waterproofing.

PART 2 – PRODUCTS

2.01 DAMP-PROOFING
- A. Hot Asphaltic Materials:
  1. Emulsified Asphalt: Reinforced with non-asbestos substrate.
  2. Asphalt Primer: Compatible with substrate.

2.02 WATERPROOFING

A. Modified Bitumen Sheet Waterproofing Properties:
   1. Tensile Strength: ASTM D412, Die C: Minimum two hundred-fifty (250) psi.
   2. Ultimate Elongation: ASTM D412, Die C: Minimum three hundred percent (300%).
   3. Water Vapor Transmission (Perms): ASTM E96, Method B: Maximum 0.1.
   4. Pliability: ASTM D146: No cracks at minus twenty-five (25) degrees Fahrenheit.
   5. Puncture Resistance: ASTM E154: Minimum forty (40) pounds.
   6. Cycling Over Crack: ASTM C836 at minus fifteen (15) degrees Fahrenheit or lower: No effect one hundred (100) cycles.
   7. Cycling over one (1) inch at minus fifteen (15) degrees Fahrenheit: No effect one thousand (1,000) cycles.

2.03 LOW SLOPE ROOFING

A. Less than or equal to two to twelve (2:12).

2.04 STEEP SLOPE ROOFING

A. Greater than two to twelve (2:12).
B. Shingles: Asphalt composition T-lock; wood must be coordinated with the Owner.
C. Roofing Tiles: Coordinate with Owner for use.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Perform Work in accordance NRCA – Waterproofing Manual, manufacturer's details, and all applicable codes and standards.

END OF SECTION 07 10 00

07 20 00 – THERMAL PROTECTION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for thermal protection. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Installer shall be a firm which has had at least five (5) years of successful experience in application of spray polyurethane foam products.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. General: All insulation must be monolithic (no seams). The product shall exhibit the following typical physical properties:
   1. Density (Sprayed-in-Place): 1.9 pcf minimum.
   2. Compressive Strength: Twenty-one (21) psi minimum.
   3. Tensile Strength: Thirty-six (36) psi minimum.
   4. Closed Cell Content: Ninety percent (90%) minimum.
   5. K Factor Initial: 0.16.
   6. R Value: Twenty (20) minimum.
   7. Flame spread (ASTM E-84) seventy-five (75) maximum (this numerical flame spread rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.)

B. Spray Foam shall be a two (2) component polyurethane foam system formulated for use through airless equipment. The product shall be a closed cell, non-ozone depleting propellent based spray foam. In addition, no carbon dioxide blown (water blown) foams shall be allowed.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Roof and Deck Insulation Applications/Restrictions
   1. Net Insulation Design Goals for Roof System: Minimum shall be as required by applicable codes. LTTR shall be considered.
   2. Rigid Roof Insulation: Tongue and groove single layer or multiple layers with staggered joints.

END OF SECTION 07 20 00

07 54 23 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for thermoplastic polyolefin (TPO) roofing.
  1. Adhered thermoplastic polyolefin (TPO) roofing system.
  2. Mechanically fastened, thermoplastic polyolefin (TPO) roofing system.
  3. Substrate board.
  4. Vapor retarder.
  5. Roof insulation.
  6. Cover board.
  7. Walkways.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 RELATED SECTIONS
- A. Sections: All sections related to roofing work.

1.04 DEFINITIONS
- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.05 SUBMITTALS REQUIRED
- A. Action Submittals
  1. Product Data: For each type of product.
     a. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.
  2. Shop Drawings:
     a. Include roof plans, sections, details, and attachments to other work, including the following:
        i. Layout and thickness of insulation.
        ii. Base flashings and membrane termination details.
        iii. Flashing details at penetrations.
        iv. Tapered insulation layout, thickness, and slopes.
        v. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
        vi. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
        vii. Tie-in with adjoining air barrier.
  3. Samples for Verification:
     a. For the following products:
        i. Roof membrane and flashings, of color required.
        ii. Roof paver in each color and texture required.
        iii. Walkway pads or rolls, of color required.
  4. Wind Uplift Resistance Submittal:
     a. For roofing system, indicating compliance with wind uplift performance requirements.

b. Include wind uplift performance warranty confirmation.

B. Informational Submittals
   1. Qualification Data: For installer and manufacturer.
   2. Manufacturer Certificates:
      a. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
         i. Submit evidence of compliance with performance requirements.
      b. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
   3. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
   4. Evaluation Reports: For components of roofing system, from ICC-ES.
   5. Field Test Reports:
      a. Concrete internal relative humidity test reports.
      b. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
   6. Field Quality-Control Reports
      a. Sample Warranties: For manufacturer's special warranties.

C. Preinstallation Meetings
   1. Preinstallation Roofing Conference: Conduct conference at project site.
      a. Meet with Owner, Architect or Consultant, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

D. Closeout Submittals
   1. Maintenance Data: For roofing system to include in maintenance manuals.
   2. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in SPRI's Directory of Roof Assemblies for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified contractor that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. The contractor specializing in performing Work of this section with minimum five (5) years documented experience TPO roof systems in Colorado and approved by manufacturer. A supervisor shall be on the job site at all times while roofing is in progress.

C. Mockups: Full-size physical assemblies that are constructed as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROCEDURES AND REQUIREMENTS

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
   1. Accelerated Weathering: Roof membrane shall withstand two thousand (2000) hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
   2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
C. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low slope roof products.
D. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

1.09 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to the manufacturer’s written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, substrate board, roof pavers, and other components of roofing system.
   2. Warranty Period: Twenty (20) years from date of Substantial Completion.
      a. One hundred-ten (110) mph wind speed warranty.
B. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers and/or walkway products, for the following warranty period:
   1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer(s) approved by roof membrane manufacturer.
C. Thickness: Sixty (60) millimeters, nominal.
D. Exposed Face Color: Tan.

2.02 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
   1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, fifty-five (55) millimeters thick, minimum, of same color as TPO sheet.
C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
D. Roof Vents: As recommended by roof membrane manufacturer.
   1. Size: Not less than four (4) inch diameter.
E. Bonding Adhesive: Manufacturer's standard or low VOC as specified by Owner.
F. Slip Sheet: Manufacturer's standard of thickness required for application.
G. Vented Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt-impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately one (1) by one-eighth (1/8) inch-thick; with anchors.
I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately one (1) inch-wide by 0.05-inch thick, pre-punched.
J. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.03 SUBSTRATE BOARDS

A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.
   1. Thickness: One-quarter (¼) inch, one-half (½) inch, or Type X, five-eighths (5/8) inch-thick.
   2. Surface Finish: Factory primed or unprimed.
B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.04 VAPOR RETARDER

A. Polyethylene Film: ASTM D4397, ten (10) millimeters thick, minimum, with maximum permeance rating of 0.13 perm.
   1. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
   2. Adhesive: Manufacturer's standard lap adhesive, listed by FM Approvals for vapor retarder application.
B. Self-Adhering-Sheet Vapor Retarder: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum forty (40) millimeter total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
C. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum thirty (30) millimeters total thickness; maximum permeance rating of 0.1

perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.05 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer**,** approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Compressive Strength: Twenty (20) psi**.**
2. Size: Forty-eight (48) inches by forty-eight (48) inches or forty-eight (48) inches by ninety-six (96) inches as required for system.
3. Two 92) or more layers to achieve the required R-value indicated in the applicable codes and standards.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Polyisocyanurate.
2. Minimum Thickness: One-quarter (¼) inch.
3. Slope:
   a. Roof Field: One-quarter (¼) inch per foot (One to forty-eight (1:48)) unless otherwise indicated on Drawings.
   b. Saddles and Crickets: One-half (½) inch per foot (One to twenty-four (1:24)) unless otherwise indicated on Drawings.

2.06 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board:

1. ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
   a. Thickness: One-half (½) inches.
   b. Surface Finish: Factory primed.
2. ASTM C1325, fiber-mat-reinforced cementitious board, seven-sixteenth (7/16) inch-thick.
3. ASTM C1289 Type II, Class 4, Grade 1, one-half (½) inch-thick polyisocyanurate, with a minimum compressive strength of eighty (80) psi.

2.07 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately three-sixteenth (3/16) inch-thick and acceptable to roofing system manufacturer.

1. Size: Approximately thirty-six (36) inches by sixty (60) inches.
2. Pathway: Provided to all equipment. To be reviewed and approved by Owner.

B. Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, square edged with top edges beveled three-sixteenth (3/16) inch, factory cast for use as roof pavers; absorption not greater than five percent (5%), ASTM C140/C140M; no breakage and maximum one percent (1%) mass loss when tested for freeze-thaw resistance, ASTM C67.

2.08 PIPE AND DUCT SUPPORTS

A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate or one hundred percent (100%) recycled rubber pipe stand accommodating up to three (3) inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for

penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with polycarbonate roller carrying assembly accommodating the diameter of pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

C. Adjustable-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless steel threaded rod designed for adjusting support height, accommodating the diameter of the pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements for steel decking.
   4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than seventy-five percent (75%), or as recommended by roofing system manufacturer, when tested according to ASTM F2170.
   6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
   7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
   8. Verify any damaged sections of roof decks have been repaired or replaced.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
   1. Submit test result within twenty-four (24) hours after performing tests.
      a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

D. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

3.03 INSTALLATION

A. Roofing – General

1. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday. Remove and discard temporary seals before beginning Work on adjoining roofing.
3. Install roof membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and if applicable to not void warranty for existing roofing system.
4. Coordinate installation and transition of roofing system component serving as an air barrier with specified air barrier.

B. Substrate Board
    a. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than twenty-four (24) inches in adjacent rows. Tightly butt substrate boards together and around penetrations and projections.
    b. At steel roof decks, install substrate board at right angle to flutes of deck.
        i. Locate end joints over crests of steel roof deck.

C. Vapor Retarder
    1. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of two (2) inches and six (6) inches, respectively.
        a. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
        b. Continuously seal side and end laps with tape or adhesive.
    2. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of two (2) inches and six (6) inches, respectively.
        a. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
        b. Continuously seal side and end laps with tape.
    3. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of three and one-half (3½) inches and six (6) inches, respectively.
        a. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
        b. Seal laps by rolling.
    4. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

D. Insulation
    1. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
    2. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

E. Cover Boards
    1. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of six (6) inches in each direction.

2. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

F. Adhered Roof Membrane
   1. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

G. Mechanically Fastened Roof Membrane
   1. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

H. Base Flashing
   1. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

I. Walkways
   1. Flexible Walkways:
      a. Install flexible walkways at the following locations:
         i. Perimeter of each rooftop unit.
         ii. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
         iii. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
         iv. Top and bottom of each roof access ladder.
         v. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
         vi. Locations indicated on Drawings.
         vii. As required by roof membrane manufacturer's warranty requirements.
         viii. Maximum of six (6) inch clearance between adjoining pads.
   2. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Owner.

B. Owner may engage a qualified testing agency to perform one or more of the following tests:
   1. Flood Testing: Flood test each roof area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
      a. Perform tests before overlying construction is placed.
      b. Flood to an average depth of two and one-half (2½) inches with a minimum depth of one (1) inch and not exceeding a depth of four (4) inches**.** Maintain two (2) inches of clearance from top of base flashing.
      c. Flood each area for twenty-four (24) hours.
      d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
         i. Cost of retesting is Contractor's responsibility.
      e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.
   2. Infrared Thermography: Testing agency shall survey entire roof area using infrared color thermography according to ASTM C1153.

a. Perform tests before overlying construction is placed.
b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
    i. Cost of retesting is Contractor's responsibility.
d. Testing agency shall prepare survey report of initial scan indicating locations of entrapped moisture, if any.

3. Electrical Capacitance/Impedance Testing: Testing agency shall survey entire roof area for entrapped water within roof assembly according to ASTM D7954/D7954M.
    a. Perform tests before overlying construction is placed.
    b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
        i. Cost of retesting is Contractor's responsibility.
    c. Testing agency shall prepare survey report indicating locations of entrapped moisture, if any.
4. Nuclear Hydrogen Detection Testing: Testing agency shall survey entire roof area for entrapped water within roof assembly according to ANSI/SPRI/RCI NT-1.
    a. Perform tests before overlying construction is placed.
    b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
        i. Cost of retesting is Contractor's responsibility.
    c. Testing agency shall prepare survey report indicating locations of entrapped moisture, if any.
5. Low-Voltage Electrical Conductance Testing: Testing agency shall survey entire roof area and flashings to locate discontinuity in the roof membrane using an exposed metal electrical loop to create an electrical field tested with handheld probes or a scanning platform with integral perimeter electrical loops creating a complete electrical field.
    a. Perform tests before overlying construction is placed.
    b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
        i. Cost of retesting is Contractor's responsibility.
    c. Testing agency shall prepare survey report indicating locations of initial discontinuities, if any.
6. High-Voltage Spark Testing: Testing agency shall survey entire roof area, flashings, and parapet walls to locate discontinuity in the roof membrane using an electrically charged metal "broom head."
    a. Perform tests before overlying construction is placed.
    b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
        i. Cost of retesting is Contractor's responsibility.
    c. Testing agency shall prepare survey report indicating locations of initial discontinuities, if any.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect/Engineer, and to prepare inspection report.
D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.05 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23

07 62 00 – SHEET METAL FLASHING (TPO ROOFING ONLY)

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for sheet metal flashing (TPO roofing only).
   1. Manufactured reglets with counterflashing.
   2. Formed roof-drainage sheet metal fabrications.
   3. Formed low-slope roof sheet metal fabrications.
   4. Formed steep-slope roof sheet metal fabrications.
   5. Formed wall sheet metal fabrications.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 SUBMITTALS REQUIRED

A. Action Submittals
   1. Product Data: For all materials and sealants.
   2. Shop Drawings: For sheet metal flashing and trim.
      a. Include plans, elevations, sections, and attachment details.
      b. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
      c. Include identification of material, thickness, weight, and finish for each item and location in Project.
      d. Include details for forming, including profiles, shapes, seams, and dimensions.
      e. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
      f. Include details of termination points and assemblies.
      g. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
      h. Include details of roof-penetration flashing.
      i. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
      j. Include details of special conditions.
      k. Include details of connections to adjoining work.
   3. Samples: For each exposed product and for each color and texture specified, twelve (12) inches long by actual width.

B. Informational Submittals
   1. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
   2. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction or ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
   3. Sample warranty.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.06 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    a. Color fading more than five (5) Delta E units when tested in accordance with ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the design pressure as required for the Project.

D. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification. Identify materials with name of fabricator and design approved by FM Approvals.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: One hundred-twenty (120) degrees Fahrenheit, ambient; one hundred-eighty (180) degrees Fahrenheit, material surface.

2.02 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat with manufacturer's standard clear acrylic coating on both sides.

2. Exposed Coil-Coated Finish:
    a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than seventy percent (70%) polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 MILs for primer and 0.8 MILs (0.02 millimeter) for topcoat.
3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 MIL.

C. TPO Coated Sheet: Provide zinc-coated (galvanized) steel sheet with a layer of forty (40) MIL non-reinforced TPO coating.
1. Thickness: 0.028 inches.
2. Color: Tan.

2.03 UNDERLAYMENT MATERIALS

A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over two hundred-twenty (220) degrees Fahrenheit; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.

B. Self-Adhering, High-Temperature Sheet Underlayment: Minimum thirty (30) MILs thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus twenty (20) degrees Fahrenheit or lower.

C. Slip Sheet: Rosin-sized building paper, three (3) pounds per one hundred (100) square feet minimum.

2.04 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

C. Sealant Tape: Pressure-sensitive, one hundred percent (100%) solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape one-half (½) inch-wide and one-eighth (1/8) inch-thick.

D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two (2) part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.05 FABRICATION − GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
   1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
   4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
B. Fabrication Tolerances:
   1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of one-quarter (¼) inch in twenty (20) feet on slope and location lines indicated on Drawings and within one-eighth (1/8) inch offset of adjoining faces and of alignment of matching profiles.
   2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.
D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
G. Seams:
   1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.06 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:
   1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
   2. Fabricate in minimum one hundred-twenty (120) inch-long sections.
   3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
   4. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
   5. Accessories: Wire-ball downspout strainer.
B. Built-in Gutters:

1. Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
2. Fabricate in minimum one hundred-twenty (120) inch-long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
3. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
4. Accessories: Wire-ball downspout strainer.

C. Downspouts: Fabricate round, rectangular or open-face downspouts to dimensions indicated on Drawings or to match existing, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

D. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, four (4) inch-wide wall flanges to interior, and base extending four (4) inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. TPO Coated Steel: 0.028-inch-thick.
2. Galvanized Steel: 0.028-inch-thick.
3. Aluminum-Zinc Alloy-Coated Steel: 0.028-inch-thick.

E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
1. Galvanized Steel: 0.028-inch-thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028-inch-thick.

2.07 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum one hundred-twenty (120) inch long but not exceeding twelve (12) foot-long sections. Furnish with six (6) inch wide, joint cover plates.
1. Fabricate from the following materials:
a. Galvanized Steel: 0.028-inch-thick.
b. Aluminum-Zinc Alloy-Coated Steel: 0.028-inch-thick.

B. Copings: Fabricate in minimum one hundred-twenty (120) inch long, but not exceeding twelve (12) foot long, sections. Fabricate joint plates of the same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight.
1. Fabricate from the following materials:
a. Galvanized Steel: 0.034-inch-thick.
b. Aluminum-Zinc Alloy-Coated Steel: 0.034-inch-thick.

C. Counterflashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028-inch-thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028-inch-thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028-inch-thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028-inch-thick.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Underlayment
1. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
a. Install in shingle fashion to shed water.

b. Lap joints not less than two (2) inches.

2. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
   a. Lap horizontal joints not less than four (4) inches.
   b. Lap end joints not less than twelve (12) inches.
3. Self-Adhering, High-Temperature Sheet Underlayment:
   a. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
   b. Prime substrate if recommended by underlayment manufacturer.
   c. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
   d. Apply in shingle fashion to shed water, with end laps of not less than six (6) inches staggered twenty-four (24) inches between courses.
   e. Overlap side edges not less than three and one-half (3½) inches. Roll laps and edges with roller.
   f. Roll laps and edges with roller.
   g. Cover underlayment within fourteen (14) days.
4. Install slip sheet (if applicable), wrinkle free, over underlayment before installing sheet metal flashing and trim.
   a. Install in shingle fashion to shed water.
   b. Lap joints not less than four (4) inches.

B. General
1. Install sheet metal flashing and trim to comply with details indicated and recommendations of sheet metal standard and all applicable codes that apply to installation characteristics required unless otherwise indicated on Drawings.
2. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
3. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
4. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
   a. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
5. Seal joints as required for watertight construction.
   a. Use sealant-filled joints unless otherwise indicated.
   b. Prepare joints and apply sealants to comply with requirements indicated in manufacturer’s installation instructions.
6. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

C. Roof-Drainage System
1. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
2. Hanging Gutters:
   a. Join sections with joints sealed with sealant.
   b. Provide for thermal expansion.
   c. Attach gutters at eave or fascia to firmly anchor them in position.

d. Provide end closures and seal watertight with sealant.
e. Slope to downspouts.
f. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, fifty (50) feet apart. Install expansion-joint caps.

3. Built-in Gutters:
   a. Join sections with joints sealed with sealant.
   b. Provide for thermal expansion.
   c. Slope to downspouts.
   d. Provide end closures and seal watertight with sealant.
   e. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
   f. Lap sides minimum of two (2) inches over underlying course.
   g. Lap ends minimum of four (4) inches.
   h. Stagger end laps between succeeding courses at least seventy-two (72) inches.
   i. Fasten with roofing nails or as required by manufacturer.
   j. Install slip sheet over underlayment.
   k. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, fifty (50) feet apart. Install expansion-joint caps.
4. Downspouts:
   a. Provide hangers with fasteners designed to hold downspouts securely to walls.
   b. Locate hangers at top and bottom and at approximately sixty (60) inches o.c.
   c. Provide elbows at base of downspout to direct water away from building.
   d. Connect downspouts to underground drainage system.
5. Parapet Scuppers:
   a. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   b. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
   c. Loosely lock the front edge of the scupper with conductor head.
   d. Seal with elastomeric sealant to exterior wall scupper flanges into back of conductor head.
6. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of one (1) inch below scupper or gutter discharge.
7. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of four (4) inches in direction of water flow.

D. Roof Flashings
1. Install sheet metal flashing and trim to comply with performance requirements**,** sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
   a. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
   b. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
2. Roof Edge Flashing:
   a. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
   b. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered three (3) inch centers.

c. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

3. Copings:
   a. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
   b. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
   c. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
4. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of four (4) inches over base flashing. Install stainless steel draw band and tighten.
5. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
   a. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
   b. Extend counterflashing four (4) inches over base flashing.
   c. Lap counterflashing joints minimum of four (4) inches.
6. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

E. Tolerances
1. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of one-quarter (¼) inch in twenty (20) feet on slope and location lines indicated on Drawings and within one-eighth (1/8) inch offset of adjoining faces and of alignment of matching profiles.

3.02 CLEANING AND PROTECTION

A. Cleaning
1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
2. Clean off excess sealants.

B. Protection
1. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
2. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

DIVISION 08: Openings

08 05 00 – COMMON WORKS RESULTS FOR OPENINGS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for openings. Additional requirements may be included within specific agreements or other contracting documents.

B. Contractor will provide a Knox box and mount as directed by the AHJ.

1.03 QUALITY ASSURANCE

A. Energy Efficient Requirements

1. Window frames shall have thermal break for energy conservation.
2. Windows specified shall be thermally efficient and all glass shall be minimum double pane insulating glass.
3. Energy Efficiency: Provide Energy Star labeled products as appropriate to climate zone.
4. Glazing shall be energy efficient (ie, Low-E) and have an insulated glass certification.
5. Use thermally broken sections if metal windows frames are used. Do not use steel windows in exterior applications.

B. Warranty

1. Submit written agreement on door manufacturer's standard form, signed by manufacturer, installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) more or that show telegraphing of core construction in face veneers which do not comply with tolerances in referenced quality standard for life of installation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not store in damp or wet areas or in areas where sunlight might bleach veneer. Open packaging to permit ventilation.

B. Stored in an upright position under cover. Place units on at least four (4) inch wood sills on floors in a manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters, which create humidity, chamber and promote rusting. Provide one-quarter (¼) inch space between the products to promote air circulation.

C. Assembled frames shall be stored in a vertical position, five (5) units maximum in a stack. Provide a one-quarter (¼) inch space between frames to promote air circulation.

D. Do not deliver or install wood/interior doors until building (door storage area) is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

E. Use removable tags or concealed markings.

F. Rust on frames or doors will constitute rejection of assembly in full.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. See Divisions 01 for general sustainability requirements.

2.02 DOORS

A. The exterior glazed portions within a door shall be of sealed insulated double glass units. All doors must meet the minimum three (3) feet wide.
B. If there is an entrance door to a restroom, it must swing out.
C. Provide vestibules for all entrances except the following:
    1. The door is used primarily to facilitate vehicular movement or material handling
    2. The door is not intended to be used as a general entrance door for either the public or staff.
    3. The door opens directly from an enclosed space of less than one thousand-six hundred-fifty (1,650) square feet in area.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prepare and hang doors when temperature and humidity range of spaces is consistent with final use and maximum fifty-five percent (55%) humidity.

3.02 INSTALLATION

A. Set steel frames accurately, straight and free of twist with head level and jambs plumb. Rigidly anchor to walls and partitions and securely brace until surrounding work is completed.
B. Field welds full length of joints. Remove splatter; grind exposed welds to match adjacent surfaces.
C. Leave spreader bars in place until frames are securely anchored.
D. Jambs will be filled with grout where frames occur in masonry walls. Coat throat of frames in masonry walls with bituminous coating.
E. Jambs, heads, and sills in construction will be filled with minimal expanding foam spray.
F. Install doors to clear finished flooring over which door leaf swings. Do not trim stiles and rails in excess of limits set by manufacturer.
G. Tolerances:
    1. Maximum Diagonal Distortion (Warp), Measured with Straight Edge, Corner to Corner:
        a. Metal: One-sixteenth (1/16) inch.
        b. Wood: One-quarter (¼) inch over an imaginary three (3) foot, six (6) inches by seven (7) foot surface area.
    2. Maximum Vertical Distortion (Bow): One-quarter (¼) inch measured with straight edge or taut string, top to bottom, over an imaginary three (3) foot, six (6) inches by seven (7) foot surface area.
    3. Maximum Width Distortion (Cup): One-quarter (¼) inch measured with straight edge or taut string, edge to edge, over an imaginary three (3) foot, six (6) inches by seven (7) foot surface area.
    4. Clearances of Doors in Frames:
        a. Non-Fire Rated Openings:
            i. Jambs:
                1. Metal: Three-thirty-second (3/32) inch.
                2. Wood: One-eighth (1/8) inch, One-eighth (1/8) inch bevel in two (2) inches.
            ii. Heads:
                1. Metal: Three-thirty-second (3/32) inch.
                2. Wood: One-eighth (1/8) inch.
            iii. Between Double Doors: One-eighth (1/8) inch maximum.
            iv. Bottom:
                1. Metal: One-quarter (¼) inch above finished floor and thresholds.

2. Wood: Three-eighth (3/8) inch (decorative floor); one-eighth (1/8) inch (threshold).

b. Rated Openings: Comply with NFPA Standard No. 80; job cutting and fitting not permitted, except bottom edge only.

c. Frame Anchors: Minimum two (2) per three (3) feet at each jamb as follows:

5. Install roll formed steel reinforcement channels between two (2) abutting frames. Anchor to structure and floor.
6. Adjust doors for smooth and balanced door movement.
7. Packaged Vision Lights: All window kits made or used by approved door manufacturers will be considered for approval, all window kits should be approved by Owner on each project to ensure they match existing; all glass selections shall be approved by Owner.
8. Louvers: All louvers made by approved manufacturers will be considered for approval. All louvers shall be approved by Owner on each project to ensure they match existing.

3.03 CLEANING AND PROTECTION

A. All doors shall be protected from damage during construction. If work is going on inside of room/area and equipment is being moved in and out of opening, the doors shall be removed or protected in such a manner as to preserve original condition. Any damage to doors must be repaired and doors refinished to match factory finish prior to damage.

B. Existing and new doors must be cleaned thoroughly after completion of work to match original or factory cleanliness.

END OF SECTION 08 05 00

08 11 00 – METAL DOORS AND FRAMES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for metal doors and frames.
   1. Steel doors and frames.
   2. Fire rated and non-rated installations.
   3. Interior borrowed lights.
   4. Fixed hollow metal panels.
   5. Glazing stops.
   6. Custom door designs must be submitted and approved by the Owner. All hardware used in custom doors must be from Owner approved manufacturers.

B. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 DOORS AND FRAMES

A. Exterior doors and frames shall be certified to exceed two million (2,000,000), full load operating cycles by a recognized independent testing laboratory. Doors, frames, and frame components shall be manufactured from hot-dipped galvanized steel having an A60 zinc coating. Galvanized steel shall be treated to ensure proper paint adhesion. All component parts used in galvanized doors and/or frames shall meet the galvanize specification.

2.02 DOORS

A. Exterior doors shall not be less than sixteen (16) gauge. Exterior frames shall not be less than fourteen (14) gauge.

B. Interior doors shall not be less than eighteen (18) gauge. Interior frames shall not be less than sixteen (16) gauge.

C. Insulate exterior doors and frames

D. Construction of Doors:
   1. Flush doors shall be full flush, fully welded seamless construction.
   2. Doors shall have beveled one-eighth (1/8) inch in two (2) inch hinge and lock edges.
   3. Top and bottom steel reinforcement channels shall be fourteen (14) gauge and spot welded to both panels. Top channel must be flush with no holes or openings, top caps are acceptable if no holes or openings are exposed, bottom must be inverted.
   4. Hinge reinforcements shall be seven (7) gauge for one and three-quarter (1¾) inch doors. Lock reinforcements shall be sixteen (16) gauge and closer reinforcements fourteen (14) gauge box minimum twenty (20) inches long. Hinge and lock reinforcements shall be projection welded to the edge of the door. Galvanized doors shall have galvanized hardware reinforcements. Adequate reinforcements shall be provided for other hardware as required.
   5. All cutouts in doors shall have fourteen (14) gauge steel reinforcement in the cut out of the door.
   6. Continuous hinge reinforcement shall be full length.

7. Fire-rated doors and frames shall be constructed in accordance with NFPA 80.
8. Prepare frames and doors for specified finishing and security hardware with mortises and reinforcement. Provide ten (10) gauge steel plate reinforcement for hinges, electric strikes and electric contactors, and twelve (12) gauge for pushes, pulls, lock and latch sets, and panic devices. Drill and tap to template information. Reinforce for surface-mounted hardware and for door closer brackets. Provide for concealed door closers where specified. Install twenty-two (22) gauge metal mortar guards at cutouts and reinforcing plates in frame. For cylindrical locks, install reinforcing units to lock manufacturer's specification. For mortise locks provide a suitable internal bracket to hold the lock rigidly in the center of the door.
9. Exterior hollow metal doors and frames to be galvanizes and doors to have tops flush with skins to prevent moisture from forming.

E. Steel Panels: Hollow metal insulated steel panels shall conform to material and construction requirements for steel doors.

2.03 FRAMES

A. Exterior frames shall be fourteen (14) gauge galvanized.
B. Interior frames shall be sixteen (16) gauge, provide fourteen (14) gauge steel for frames over forty-two (42) inches wide.
C. Construction of Frames:
   1. Flush frames shall be formed from sixteen (16) or fourteen (14) gauge cold-rolled or galvanized steel.
   2. Metal plaster guards shall be provided for all mortised cutouts and on hinge side of frames receiving full length continuous hinges and for all hardware mounted to frame.
   3. Hinge reinforcements shall be seven (7) gauge steel. Strike reinforcements shall be sixteen (16) gauge steel. All hinge and strike reinforcements shall be projection welded to the door frame.
   4. Reinforcements for surface closer shall be seven (7) gauge steel. Adequate reinforcements shall be provided for other hardware when required. Galvanized frames shall have galvanized hardware reinforcements.
   5. All exposed frame anchors must be flushfilled.
   6. Continuous hinge reinforcement shall be full length, seven (7) gauge plate and face or rabbet of frame.
   7. Drill stop of lock jamb of each interior frame for installation of rubber door silencers.
   8. Install one-half (½) inch conduit in door frame plaster boxes that have electrical products attached to them that runs to accessible ceiling. Wire is not to be grouted into frame.

PART 3 – EXECUTION

3.01 CLEANING AND PREPARATION

A. All doors shall be protected from damage during construction. If work is going on inside of room/area and equipment is being moved in and out of opening, the doors shall be removed or protected in such a manner as to preserve original condition. Any damage to doors must be repaired and doors refinished to match factory finish prior to damage.
B. Existing and new doors must be cleaned thoroughly after completion of work to match original or factory cleanliness.

END OF SECTION 08 11 00

08 14 00 – WOOD, LAMINATE, AND SPECIALTY DOORS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for wood, laminate, and specialty doors.
   1. Interior wood, laminate, and specialty doors.
      a. Non-rated.
      b. Fire-rated.
      c. Factory finished.
      d. Packaged vision lights.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Seal door top and bottom edge with color sealer to match door facing.

B. Installer shall be knowledgeable of NFPA requirements for the installation of fire rated doors and experienced in preparation and hanging of doors meeting the tolerances required.

PART 2 – PRODUCTS

2.01 WOOD DOORS: INTERIOR

A. Grade: AWI “Custom;” NWWDA “Premium”, Grade AA faces.

B. Construction:
   1. Solid Core, five (5) ply, one and three-quarters (1¾) inch-thick.
   2. Core may be twenty-two (28) pound high density particle board (formaldehyde free).

C. Components
   1. Solid Core: Solid particle board core. Conform to fire rated construction where scheduled and requirements of UL 1784 for core material firestop systems.
   2. Blocking: Eight (8) inch top rail blocking at all doors indicated to receive closers; five (5) inch bottom rail blocking at all doors indicated to receive kick, mop or armor plates; five (5) inch mid-rail blocking at all doors indicated to receive exit devices.
   3. STC 30 minimum.

D. Fire Rated Construction: NFPA 80 and UL 1784.
   1. Twenty (20) Minute Rated: Particle board core or mineral core.
      a. Sixty (60) Minute Rated: Mineral core; SLM blocking at hardware locations.
      b. Ninety (90) Minute Rated: Mineral core; SLM blocking at hardware locations.
      c. Glazing Stops:
         i. Solid matching wood with clips or as required for fire rating.
      d. Attach fire rating label on hinge jamb.
      e. Factory machine doors for finish hardware.

2.02 FINISH

A. Hardwood Veneer: Plain sliced, book match grain; factory finish (unless job is a partial remodel, then new doors shall match exiting door veneers; Owner shall approve the match). Veneer shall

be clear, free of all heartwood discoloration, color streaks and irregular figure coloration. Matching between paired doors shall be in sequence. No taped edges. Should have hardwood stile and rails, rails bonded to core. Styles shall match wood of same species as faces for transparent finish. Samples shall be provided to Owner to match existing doors at site.

B. Wood Species: Select Red Oak is preferred but other species are acceptable if approved by Owner.

PART 3 – EXECUTION

3.01 CLEANING AND PROTECTION

A. All doors shall be protected from damage during construction. If work is going on inside of room/area and equipment is being moved in and out of opening, the doors shall be removed or protected in such a manner as to preserve original condition. Any damage to doors must be repaired and doors refinished to match factory finish prior to damage.

B. Existing and new doors must be cleaned thoroughly after completion of work to match original or factory cleanliness.

END OF SECTION 08 14 00

08 31 00 – ACCESS DOORS AND PANELS

5/25

PART 1 – GENERAL

1.01 RELATED DOCMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for access doors and panels.
   1. Access doors into pipe.
   2. Utility.
   3. Equipment spaces and elsewhere shown.

B. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. Size: Coordinate with Owner for specific installations. Provide minimum two (2) foot clear for locations required to be accessed by maintenance personnel.

B. Location: Easily accessible to the most extent possible, coordinate with Owner.

C. Locking Devices: Cam locks.

D. Finish: Factory painted (baked on) or painted to match adjacent finishes as determined by Owner.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 08 31 00

08 33 23 – OVERHEAD FIRE RATED COILING DOORS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for:
  1. Overhead fire rated coiling doors with accessories.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE
- A. Performance Description
  1. Ninety (90) minute fire UL rated roll up shutters automatically activated by fire alarm and/or fusible link, with keyed three position control station for night security/daytime use lock up where in publicly accessible areas, or three button control station for night security/daytime use lock up where only accessible to staff. Door must be resettable after fire alarm activation by Owner using electrically operated key switch. System shall meet requirements of the latest IBC.
  2. All fire rated overhead coiling doors shall have electric operation.

PART 2 – PRODUCTS

2.01 CURTAIN
- A. Twenty (20) gauge stainless steel with #4 finish.

2.02 GUIDES
- A. Minimum three-sixteenth (3/16) inch stainless steel.

2.03 CROSSHEAD COUNTERBALANCE SHAFT
- A. Steel pipe with closed ends of sufficient diameter to ensure minimum deflection. Balance with adjustable spring tension provided by helical steel springs to produce sufficient torque assuring smooth, correct operation of shutter from any position.

2.04 HOOD
- A. Twenty-four (24) gauge stainless steel with a #4 finish. Minimum one-quarter (¼) inch-thick intermediate supports to prevent sag.
  1. Flame stop baffle.
  2. Fascia trim where mounted within jambs.
- B. BOTTOM BAR
  1. Match curtain finish.
- C. BRACKETS
  1. One-quarter (¼) inch-thick steel plate, to support guide extensions and form end closure support for hood.
     a. Governor: Reduces average closing speed to between six (6) inches and two (2) feet per second.
- D. HARDWARE
  1. Motor override switch. Resettable after fire alarm activation by Owner using key switch.
- E. SAFETY FEATURES
  1. Time delay connected to power and fire alarm system. Automatic sensing reverse device.

2. Automatic activation by fire alarm and/or fusible link. Ladders or winding bars are prohibited.

F. INTEGRAL FRAME AND SILL
   1. Sixteen (16) gauge welded head and jambs stainless steel with #4 finish. Integral sill shall be fourteen (14) gauge stainless steel with #4 finish.

G. DISTRICT LOCKSMITH
   1. Any locks on overhead coiling doors shall take Schlage large format removable core mortise housing and should work with a Schlage mortise tailpiece.
   2. Width of door subject to Owner approval. Avoid overly wide overhead doors.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Instruct Owner regarding use, resetting after fire alarm activation.

END OF SECTION 08 33 23

08 41 13 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for aluminum-framed entrances and storefronts.
   1. Aluminum storefront framing and glazing.
   2. Break metal sills.
   3. Anchorage.
   4. Foam insulation around frames.
   5. Aluminum.
   6. Glazed aluminum curtain walls.

B. Additional requirements may be included within specific agreements or other contracting documents.

C. The following entrances and storefronts not permitted:
   1. Bronze.
   2. All-glass.
   3. Revolving doors.
   4. Balanced doors.

1.03 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturer: Single manufacturer with five-year successful in-service performance in the fabrication of assemblies of the type and quality required.
   2. Installer: Firm where work has resulted in construction with five (5) year successful in-service performance in the installation of systems similar to those required, and approved by the manufacturer.

B. Warranty
   1. Minimum five (5) years.

C. Erection Tolerances
   1. Maximum Variation from Plumb: 0.06 inch every three (3) feet non-cumulative or one-sixteenth (1/16) inch per ten (10) feet, whichever is less.
   2. Maximum Misalignment of Two Adjoining Members Abutting in Plane: One-sixty-fourth (1/64) inch.

D. Performance Requirements
   1. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system.
   2. Air Infiltration: Limit air leakage as measured in accordance with ASTM E283.
   3. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heal bead of glazing sealant.
   4. Water Leakage: None when measured in accordance with ASTM E331.
   5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of one hundred-seventy (170) degrees Fahrenheit over

a twelve (12) hour period without causing detrimental effect to system components and anchorage.
6. Allow for building deflection at head.
7. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
8. Sound Attenuation Through Wall System (Exterior to Interior): STC 50, measured in accordance with ASTM E425.
9. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

PART 2 – PRODUCTS

2.01 MATERIALS
- A. Fasteners: Aluminum non-magnetic stainless steel; concealed.
- B. Bituminous Coatings: Thirty (30) MILs cold applied asphalt mastic.
- C. Sealants and Gaskets: Permanently elastic; non-shrinking; weatherproof. Recommended by manufacturer and required in fabrication, assembly and installation of work.
- D. Treated wood blocking, shims, fillers and nailers for a secure installation.
- E. Fiberglass insulation between frames and adjacent construction.

2.02 COMPONENTS
- A. Door: A clear raceway must be provided from wire transfer location on hinge stile to junction location of any electrified hardware on door.
- B. Frame: Two (2) inch by four and one-half (4½) inch nominal dimension; thermally broken with interior tubular section insulated from exterior; flush glazing stops; end dams, drainage holes and internal weep drainage system.
  1. A clear raceway must be provided from above ceiling height to any electrical hardware junction/transfer locations for wire or tubing to be run.
- C. A clear raceway must be provided from above ceiling height to any pneumatic or electrical hardware junction/transfer locations for wire or tubing to be run.
- D. Reinforced Mullion: Of shape and structural characteristics to meet wind load requirements.
- E. Infill Panel: Mapes or Approved Equal:
  1. Outer Face: Aluminum; eight (8) feet above finished floor and lower: Fourteen (14) gauge. Above eight (8) feet high: Eighteen (18) gauge.
  2. Core: Polyisocyanurate, one (1) inch thick.
  3. Inner Face: Aluminum; eight (8) feet above finished floor and lower: Fourteen (14) gauge. Above eight (8) feet high: Eighteen (18) gauge.
  4. Smooth face, finish to match storefront.
- F. Flashings: Aluminum; Finish to match framing sections where exposed.

2.03 GLASS AND GLAZING MATERIALS
- A. Glazing Materials: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.04 FABRICATION
- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.

E. Reinforce framing members for imposed loads.

2.05 FINISHES

A. Clear Anodized Aluminum Surfaces: Conforming to AAMA 611.
B. Concealed Steel Items: ASTM A123 galvanize to two (2) ounces per square foot.
C. Apply bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar metals.
D. Extent of Finish:
    1. Apply factory coating to all surfaces exposed at completed assemblies.
    2. Apply finish to surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
    3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 – EXECUTION

3.01 PREPARATION

A. Maintain minimum ambient temperature before, during and twenty-four (24) hours after installation of glazing compounds.

3.02 INSTALLATION

A. Installation shall be completed by a qualified installer of the product specified. If Installer is also going to install hardware on the doors/openings they must have attended the pre-installation meeting for the project and meet the qualifications for an acceptable hardware Installer.
B. A pre-installation meeting shall be conducted prior to the beginning of work and the installation of hardware, electronic security hardware with the electrical contractor to review templates, installation instructions, and the approved hardware schedule. Survey installation procedures and workmanship, with special emphasis on unusual conditions, as to ensure correct technique of installation and coordination with other work.
    1. Notify required attendees at least ten (10) working days before meeting.
    2. All standards, methods, and expectations discussed at pre-installation meeting shall be the same standards, methods, and expectations to which the jobs are inspected after completion.
    3. Mock-up of all various setups required (in place mock-up is acceptable).

3.03 CLEANING AND PROTECTION

A. All doors shall be protected from damage during construction. If Work is going on inside of room/area and equipment is being moved in and out of opening, the doors shall be removed or protected in such a manner as to preserve original condition. Any damage to doors must be repaired and doors refinished to match factory finish prior to damage.
B. Existing and new doors must be cleaned thoroughly after completion of work to match original or factory cleanliness.

END OF SECTION 08 41 13

08 45 00 – TRANSLUCENT WALL AND ROOF ASSEMBLIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for translucent wall and roof assemblies.
  1. Translucent insulated wall panel system including panels and closure system.
  2. Associated flashing.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE
- A. Manufacturer: Five (5) years' experience.
- B. Installer: Five (5) years' experience and approved by manufacturer.
- C. System must be listed by ICBO.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Kalwall or approved equal.

2.02 ACCESSORIES
- A. Aluminum Extrusions: Battens clear anodized finish.
- B. Fasteners: Stainless steel. Provide exterior fasteners with double washers, steel and neoprene.
- C. Exterior Sealant Tapes: Synthetic rubber, clot reinforced, size as required.
- D. Interior Sealant Tape: Exterior grade vinyl foam tape with adhesive backing.
- E. Exterior Caulking: Silicone Sealant, color to match extrusions.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Apply backing paint on aluminum surfaces of units in contact with cementitious materials or dissimilar metals.

END OF SECTION 08 45 00

08 50 00 – WINDOWS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for windows.
  1. Aluminum window units and associated sealant work.
  2. Factory fabricated.
  3. Factory glazed.
  4. Fiberglass windows.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. All hardware, trim, and accessories necessary to provide a complete, finished installation.
- D. Foam insulation around frames.
- E. All window sashes are required to have removable stop so that glass may be easily replaced.
- F. Operable window use must be approved by Owner.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Samples.
- D. Mock-Up Panel.

1.04 QUALITY ASSURANCE
- A. Qualifications
  1. Manufacturer: Ten (10) consecutive years' experience.
  2. Installer: ASTM and AAMA Certified and approved by the window.
- B. Performance Requirements
  1. Test reports from an independent laboratory.
     a. Forced Entry Resistance: Test in accordance with ASTM F-588 and F-842. A minimum exterior and interior uniform load of one hundred-five (105) pounds per square foot shall be applied to the entire surface of the test unit. This test load shall be maintained for a period of ten (10) seconds. There shall be no permanent deformation of any frame or vent member in excess of 0.4 percent of its span.
- C. Warranty
  1. Twenty (20) year manufacturer's warranty including coverage for:
     a. Degradation of color finishes.
     b. Delamination or separation of finish cladding from wood window members.
     c. Seal failure, interpane dusting, or misting of insulated glazing units.
  2. Warranty shall include replacement of defective units.

PART 2 – PRODUCTS

2.01 ALUMINUM WINDOWS
- A. Must be thermally broken – only to be used on existing facilities to match.
- B. Match existing windows Aluminum Extrusions:

1. Alloy and temper recommended by window manufacturer for strength, corrosion resistance, and application of required finish, but not less than twenty-two thousand (22,000) psi ultimate tensile strength and not less than 0.062-inch thickness at any location for main frame and sash members. Comply with ASTM B221.

2.02 FASTENERS

A. Aluminum, non-magnetic stainless steel, epoxy adhesive or other materials warranted by the manufacturer to be non-corrosive and compatible with the aluminum window members, trim, hardware, anchors and other components of the window units.

B. Where fasteners screw-anchor into aluminum less than 0.125-inch-thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in splined grommet nuts.

C. Do not use exposed fasteners except where unavoidable for the application of hardware. Match the finish of the metal surrounding the fastener.

D. Anchors, Clips and Window Accessories: Fabricate units of aluminum, non-magnetic stainless steel, or hot-dip zinc coated steel or iron complying with ASTM A386. Provide sufficient strength to resist design pressure indicated.

2.03 SLIDING TYPE WEATHERSTRIPPING

A. Provide woven pile weatherstripping of wool, polypropylene or nylon pile and resin-impregnated backing fabric, and aluminum backing strip. Comply with AAMA 701.2.

B. Provide stripping with integral center-line barrier fin of semi-rigid plastic sheet of polypropylene.

2.04 SEALANT

A. To remain permanently elastic, non-shrinking and non-migrating.

B. Color to match the jamb of the window.

2.05 MANUFACTURED WINDOW UNITS

A. Include slide locks on secure side of windows, operating hardware, weather stripping, mullions, covers, trim, and accessories. Provide insect screens.

B. Furnish factory glazed with 0.25-inch clear tempered glass units.

2.06 FABRICATION AND ACCESSORIES

A. Fabricate without protruding screws or sharp unfinished edges.

2.07 FINISHES

A. Organic Coating:

1. Electrostatically applied baked-on fluorocarbon finish, Kynar resin as formulated by PPG, DeSoto or Glidden. Apply over five (5) step preparation and conforming to NAAMM AA-C12C42R1x and AAMA 605.2 to minimum one (1) MIL finish coating thickness.

2.08 GLAZING

A. Preglaze windows units at the factory where possible and practical for the applications indicated. Comply with ANSI/AAMA 101 and 800 Series and CPSC 16CFR Part 1201.

2.09 FIBERGLASS WINDOWS

A. CFC approves the use of fiberglass window frames for energy efficiency. These must be of commercial heavy-duty construction, able to sustain impact from vandalism. The frames should be UV resistant and not shed glass particles. Complete with removable interior stops for easy glass replacement and spare parts should be readily available. Operable panels should be awning style, no double hung.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prepare opening to permit correct installation of frame and achieve continuity of interior vapor retarder and exterior weather barrier seal.
B. Do not install sealants when ambient temperature is less than fifty (50) degrees Fahrenheit.

3.02 INSTALLATION

A. Windows shall be installed prior to masonry veneer and siding and shall be sealed to the weather barrier. Except at masonry veneer, windows shall be sealed to the weather barrier using self-adhesive flexible flashing.
B. Set units plumb, level and true to line, without warp or rack of frames or sash. Anchor securely in place. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
C. Set sill members and other members in a bed of compound with joint fillers or gaskets to provide tight construction.
    1. Windows should be installed with a sill pan, including end dams.
D. Install minimal expanding spray foam insulation to provide an air-tight seal.

END OF SECTION 08 62 00

08 62 00 – UNIT SKYLIGHTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for unit skylights.
  1. Solatube pre-manufactured skylights.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.

1.04 QUALITY ASSURANCE
- A. Warranty
  1. Ten (10) year manufacturer warranty including coverage for sealed units from seal failure, interpane dusting, misting, and replacement of defective units.
  2. Warranty shall be from General Contractor, Manufacturer and Installation subcontractor on Installation subcontractor's letterhead.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Solatube or approved equal.

2.02 IMPACT MODIFIED ACRYLIC
- A. CC2 material, 0.125-inch-thick with visible light transmission of ninety-two percent (92%) and UV transmission of 0.03 percent. UV resistant EPDM rubber weatherseal. Ceiling and dress rings of injection molded white ABS. Eight (8) inch minimum high roof flashing of 0.06-inch-thick A93003 one-piece, prefabricated aluminum to sit on curb. Provide standard angle adapters with thirty (30) degree elbows. Provide 0.015-inch-thick aluminum sheet tubes meeting ASTM B209, alloy and temper per manufacturer's standards, finished with silver film providing a minimum of ninety-five percent (95%) total reflectance and 99.9 percent specular reflectance.
- B. Color: Shall not exceed plus two (2) or be less than minus two (2) as determined in accordance to ASTM E 308. Film to be laminated with thermoset and protected with PET. Provide extension tubes required to reach from roof surface to finished ceiling heights and 0.087-inch acrylic prismatic diffuser panels with secondary lenses.
- C. Lenses and diffuser panels to be determined per install. Some provided in the past: Provide "Vusion" Frosted lenses, two (2) foot by two (2) foot transition boxes and square prismatic diffuser panels to set into acoustical ceiling grid, straight "Open Ceiling Diffuser" extension with no "Top Adjustment Tube", room darkening kits.

PART 3 – EXECUTION

3.01 PREPARATION
- A. Do not install skylights when ambient temperature is less than fifty (50) degrees Fahrenheit.
- B. Maintain minimum ambient temperature before, during and twenty-four (24) hours after installation.

3.02 INSTALLATION

A. Verify that all roof curbs are in place and weather tight.
B. Cap on curb to be one piece, no seams.

END OF SECTION 08 62 00

08 70 00 – HARDWARE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for hardware.
   1. Items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
   2. Hinges.
   3. Key control system.
   4. Lock cylinders and keys.
   5. Lock and latch sets.
   6. Flush bolts, surface bolts.
   7. Exit devices.
   8. Push/pull units.
   9. Closers.
   10. Overhead holders.
   11. Miscellaneous door control devices.
   12. Door trim units.
   13. Protection plates.
   14. Electronic security hardware.
   15. Weather stripping for exterior doors.
   16. Sound stripping for interior doors.
   17. Automatic drop seals (door bottoms).
   18. Astragals or meeting seals on pairs of doors.
   19. Thresholds.

B. Additional requirements may be included within specific agreements or other contracting documents.

C. Coordination of storefront hardware and access control keying to be reviewed and approved by Owner. Primus keyed doors will be working with Colorado Doorways.

1.03 SUBMITTALS

A. Product Data.

B. Final Hardware Schedule.

C. Keying Schedule.

D. Templates. Hardware sets should be referred to before factory/field preparation of each opening to ensure there are no hardware conflicts and all needed special templating was followed.

E. Maintenance Manuals.

F. Wiring and Riser Diagrams.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Supplier: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that

employs an experienced architectural hardware consultant (AHC) who is available at reasonable times during the course of the Work, for consultation.

B. Warranty
   1. Hardware Manufacturers Warranty: All hardware shall be free of defects and imperfections in manufacture and finish. Hardware shall be guaranteed by the manufacturer to perform all the various functions required for two (2) years from date of Final Completion.

C. Maintenance
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware. Present special tools and maintenance instructions to Owner at time of testing and demonstration interval. When a large number (fifteen (15) or more of cylindrical lockset or exit devices are used, they shall be manufactured by Schlage) are used on one project a repair kit for these items shall be specified in the Door Hardware Schedule.
   2. Pre-installation conference shall be conducted prior to installation of hardware at Project site. Meet with the Owner, Contractor, Installer, and manufacturer's representatives. A separate pre-installation conference shall be conducted prior to the installation of electronic security hardware with the electrical contractor Review, templates, installation instructions, and the approved hardware schedule. Survey installation procedures and workmanship, with special emphasis on unusual conditions, as to ensure correct technique of installation, and coordination with other work. Notify participants at least ten (10) working days before conference.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Hardware shall be labeled individually for each hardware set, any repackaging and remarking needs to be done by the supplier. Door hardware needs to be delivered to designated location and stored securely in its own non-shared location.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Any substitutions to the manufacturers listed below must be submitted to and accepted by the Owner.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Butts and Hinges:
      a. IVES Heavy Weight Ball Bearing Hinges or standard weight hinges as required in 652 finish at interior doors, 630 finish at exterior doors. Provide heavy weight hinges at main entry, exterior, or high use doors.
   2. Continuous Hinges:
      a. IVES, full mortise geared hinge for use at aluminum storefront Doors. Owner to approve.
   3. Key Control System: No substitutions allowed.
      a. Schlage Primus FSIC Key System, integrate into existing system as directed by Owner.
   4. Locksets, Latchsets and Deadbolts:
      a. Schlage ND Seriese, Rhodes Lever in 626 finish. For existing buildings, match existing building standards as specified by Owner.
      b. The Owner's sole source provider for Primus system:
         i. Colorado Doorways, Inc.
   5. Exit Devices:

a. Von Duprin:
i. Rim Devices in US26D finish. Provide 990 trim at exterior doors and lever trim 996 at interior doors. Unless otherwise specified, provide rim devices with keyed removable mullions at paired openings. Where vertical rod devices are required, use less bottom rod – Owner to review and approve. Provide QEL with LX-RX monitor switch options at electrified openings. Provide cylinder dogging at non fire rated devices unless directed otherwise.

6. Door Closers:
   a. LCN Door Closer. Provide EDA Arm at high use openings. All closers to have ST03596 special template for screw on cover.
7. Flush Bolts, Automatic Flush Bolts, Coordinators:
   a. Avoid automatic flush bolts and coordinators where possible, Owner to review and approve. Provide manual flush bolts at storage room doors and utility closets only.
8. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer. Any acceptable substitutes shall be approved by Owner.

2.02 PRODUCTS

A. Scheduled Hardware
   1. Follow Door and Hardware Institute procedures for Hardware Scheduling.
   2. Exposed non tamper proof fasteners not allowed.
B. Materials and Fabrication
   1. Follow Grade 1 requirements.
C. Hinges, Butts, and Pivots
   1. Provide the proper types to suit door and door frame requirements. For doors with closers, provide ball-bearing butts. For all other doors, provide plain bearing butts.
   2. Follow Grade 1 requirements.
   3. Exterior Doors: Stainless steel hinges.
   4. Hinge Pins: Provide hinge pins as follows:
      a. Out-Swing Doors with Locks: Non-removable pins.
      b. Interior Doors: Non-rising pins.
      c. Tips: Flat button
      d. Number of Hinges: Provide not less than three (3) hinges for door leaf for doors ninety (90) inches or less in height and one additional hinge for each thirty (30) inches of additional height. Doors forty-eight (48) inches and wider should have a fourth (4^{th}) hinge.
      e. Size of Hinges: Unless otherwise specified, hinge size for doors through three (3) feet shall be four and one-half (4½) inches by four and one-half (4½) inches.
      f. Hinges for doors over three (3) feet wide shall be four ball bearing, heavy weight, 0.190-gauge inches, five (5) inches by four and one-half (4½) inches.
   5. Available Manufacturers: Subject to compliance with requirements.
D. Continuous Hinges
   1. All continuous hinges shall be Grade 1 certified.
E. Keying Systems – Temporary
   1. The Contractor will supply and install temporary project lock cylinders during the construction period and furnish five (5) temporary construction lock keys to Owner.
   2. The Contractor will supply two (2) keys to the Owner to any temporary site gates that confine the project for the duration of the construction period.
   3. The Contractor will provide a key cabinet when needed by the project requiring building occupants and/or custodial personnel access to keys.

F. Keying Systems – Permanent
    1. Equip locks and cylinders with Schlage six (6) pin interchangeable core cylinders. Cylinders must allow for applications of multiplex keying capabilities and multiple keyways. Keying shall be performed by Schlage Lock factory or acceptable distributor.
    2. Owner shall furnish supplier with bitting list for factory to combinate locks, cylinders and cores.
    3. Furnish cylinders with temporary construction core keying system during construction period. Owner shall remove temporary construction cores and install permanent keyed cores into locksets and cylinders. Owner shall return temporary construction cores to General Contractor. General Contractor shall return temporary construction cores to supplier for credit. Do not stamp keys with bittings, keyways, or key symbols. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.
    4. Do not package permanent keys with locks. Package key separately from locksets and cores. Deliver all keys, key blanks and other security keys direct to Owner from lock manufacturer by secure courier, return receipt requested. Failure to properly comply with these requirements may be cause to require replacement of all or any part of the cylinders and keys involved as deemed necessary at no additional cost to the Owner.
    5. Key Quantity: Furnish keys in the following quantities:
        a. Two hundred (200) each Schlage Everest Primus Key Blanks of specified restricted D-keyway, the two (2) standard Everest key blanks that come with each lock core shall not be needed; please ship without theses standard pre-cut keys.
G. Locksets and Latchsets
    1. Locksets shall be Schlage primus series certified.
    2. Latchsets to have lever handles.
H. Key Control System
    1. Not required for existing buildings.
    2. Required for new buildings, coordinate with Owner.
I. Exit Devices and Mullions
    1. Exit devices, Mullions and Keyed Removable Mullion kits shall be certified Grade 1.
    2. Keyed security removable mullions shall be Grade 1 certified. Mullions to be furnished with a self-locking mechanism with Schlage Mortise cylinder Housings for re-installation. Furnish mullions with wall mounted storage kit, Owner shall determine and mark location before installation of storage kit.
J. Closers and Door Control Devices
    1. All closers shall be Grade 1 certified.
    2. Public exterior entries identified as accessible routes shall have automatic door openers.
    3. Install closers to allow maximum degree of opening, position back check to activate well in advance of the stop position to cushion the opening swing and prevent door and frame damage. Do not use door closer to stop door travel. Unless specified, install closers with through bolt mounting method on metal and wood doors.
K. Power Door Operators
    1. Where “Low Energy Power Operated Door” as defined by ANSI Standard A156.19 is indicated for doors required to be accessible. Operators shall be LCN 4630/4640.
    2. Provide two actuators per opening, one on each side of doorway for access from either direction. A third (3rd) actuator shall be provided when used in vestibules. The (3rd) button shall be in vestibule/airlock. Where buttons are hardwired a junction box in the proximity

shall be provided. Provide two (2) receivers for each door operator on a locking/exterior door and one (1) receiver for any operator on a push/pull door.

3. Hardware supplier shall provide point-to-point wiring diagrams for automatic operator(s) to general and electrical contractor prior to electrical rough in. Electrical contractor shall provide 120VAC to operator(s).
4. Available Manufacturers: Subject to compliance with requirements, see (Hardware document Tom has).
5. Wall Push-Plate Switch: Manufacturer's standard semi-flush, wall mounted, door control switch; flat push plate; all push buttons shall be submitted to and accepted by Owner. All locations of push button actuators shall be determined and marked by Owner prior to being installed.

L. Overhead Stops and Holders
   1. Overhead stops and holders shall be Grade 1 certified to meet all standards below. Coordinate overhead holder and stop mounting with door closer to facilitate the optimum degree of door opening.
   2. Where required, furnish special templating application to prevent closer and overhead stop or holder from interfering with operation.
   3. Install overhead stops and holders with one piece hex bolts and machine screws.
   4. Available Manufacturers:
      a. Glynn Johnson.

M. Protective Plates
   1. Provide manufacturers standard exposed, counter sunk holes with fasteners for door trim units, Kick plates, edge trim, push/pull plates and similar units; either machine screws or self-tapping screws. All exposed screw heads must be flush.
   2. Fabricate protection plates, armor, kick or mop, not more than two (2) inches less than door width on stop side and not more than one (1) inch less than door width on pull side, and one (1) inch less than the door width on double doors, by the height indicated.
      a. Metal Plates: Stainless steel plates 0.050, US eighteen (18) gauge.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
      a. Hager.
      b. Ives.
      c. Rockwood.

N. Door Stops
   1. Furnish heavy duty concave or convex wall stops, coincide with lock function, wherever door strikes wall. Where wall stop will not work, furnish overhead stop/holder door stop locations that do not have proper wall backing shall require an eight (8) inch by eight (8) inch wood plate or similar behind stop to prevent wall damage.
   2. Floor stops are not acceptable, unless no other option will suit the condition. Provide a wall mounted stop when opening against a wall.
   3. Where doors are unprotected, vulnerable to high-frequency use or wind conditions, on all exterior doors, provide overhead stops, unless it is specifically manufactured as a door stop arm type.
   4. Provide gray resilient rubber bumpers.
   5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
      a. Hager.
      b. Ives.

c. Rockwood.

O. Flush Bolts and Coordinators
   1. These are not recommended, however when the designer feels these are needed, Owner shall be consulted about the proper way to hardware the opening in question.

P. Electronic Security Hardware
   1. Card reader system and door hardware shall be H.I.D. proximity access readers with continental controls access controller field terminal units.
   2. Electric Power Transfer or Wire Through Hinges: Power transfers and wire through hinges shall be Grade 1 certified.
   3. Exposed door loop will not be permitted.
   4. Electric exit devices shall be operated by solenoid activated latch bolts (when Von Duprin EL device is used) or operated by electric motor (when Von Duprin QEL device is used) which can be opened momentarily or for prolonged periods of time. Fail safe design, interruption of power, device returns latch bolt to the locked position. Devices to be connected direct to security consoles or may be used as a standalone alarm station.
   5. Exterior door security exit devices shall be equipped with “latch bolt monitoring", (LX), to monitor latch bolt position. Furnish exit devices with "special dogging", (SD), feature to mechanically dog exit devices.
   6. Regulated Power Supply: Provide only UL listed, Class 2-power supply, regulated and rectified to meet electrical security hardware current requirements. Install in a secured location adjacent to the security device. Equip with hinged panel, keyed lock, sealed lead acid battery pack with capacity for three (3) hours at full load or seven (7) hours at half load of operation. Batteries shall only be required when specified by Owner. Batteries pack shall automatically recharge when failed power is restored. Provide units with terminal blocks to accept up to fourteen (14) gauge wire. Regulated power output to be field selectable for either 24VDC at two (2) ampere continuous, sixteen (16) amperes surge for three hundred (300) milliseconds or 12VDC at four (4) ampere with power input 240VAC at 0.5 ampere, capable of providing power to four security devices.
   7. Key Switches: Provide keyed cylinder switch, capable of accepting Schlage Mortise cylinder housing, to provide means of arming, disarming or resetting devices. Switches shall allow key removal when either in the armed or disarmed position. Provide indicator lamps to allow visual status of security devices. Security key switches shall be equipped with 24VDC solid state (SCR) alarm circuit containing a monitored no contact input and no alarm output, reset by activation of the key switch. Furnish two and three-quarter (2¾) inches by four and one-half (4½) inches; tamper resistant back box with one-half (½) inch knockouts for access to switch assemblies.
   8. Junction Box: Provide surface mounted, hinged door with twist turn lock, junction box with twenty (20) position terminal strips to accept twelve (12) to twenty-four (24) gauge wires. Units are to be approximately ten (10) inches high, ten (10) inches wide and six (6) inches deep, with six (6) heavy gauge steel, three-quarter (¾) inch knock outs, top, bottom, right and left side panels and back.
   9. Wiring and Riser Diagrams: Theory of operation shall be provided. Supplier shall furnish, electrical wiring and riser diagrams for low voltage security equipment specified in this section. Provide elevation drawings indicating door numbers, associated electronic security equipment such as power supplies and interconnections between door system components, control wiring for electric locks, indicator signal lights and sounding devices which are contained in the approved hardware Submittals. Elevations shall indicate standard electrical enclosures detailing the manufacturer’s space and attaching requirements.

10. Testing and Acceptance: The Contractor shall provide as part of the system start-up responsibilities, a complete data base with respect to electro-mechanical security hardware items functions and features. Testing shall include, but is not necessarily limited to, demonstration in the operational use of all electronic security hardware. Electrical circuits for each locking system opening shall be tested by the representative of the security hardware supplier and shall be certified as having compatible voltage, protection against overload and duty cycle capability consistent with the operation and installation.

Q. Thresholds, Weatherstripping and Seals
   1. Provide continuous seal at jambs and heads and at door bottom. Where specified, provide threshold type with silicone gasket. Smoke, or sound seals shall be rated in accordance with surrounding wall rating respective to sound or fire rating or as required by code. Provide metal threshold units of type, size and profile. Thresholds on exterior doors shall be one-half (½) inch tall unless requested differently be Owner. Interior thresholds shall be one-quarter (¼) inch tall unless requested differently by Owner. Provide noncorrosive fasteners for exterior and interior applications.
   2. Provide replaceable weather stripping at exterior and vestibule door openings.
   3. Extruded aluminum with color anodized finish; 0.062-inch minimum thickness of main walls and flanges. Nylon brush filament weather stripping shall be encased in an anodized aluminum flange for attachment.
   4. Fire rated, smoke and draft control doors must be installed with fire-rated smoke and draft control gasketing.
   5. All edge sealing systems required shall be supplied by door supplier.
   6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include:
      a. Pemko.
      b. National Guard.

R. Hardware Finishes
   1. Custom finishes shall be decided by Owner.
   2. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.
      a. Satin Chrome: US26D.
         i. Hinges, locksets, flush bolts, exit devices.
      b. Satin Stainless Steel, No Coating: US32D.
         i. Continuous hinges, door pulls, protective plates.
      c. Powder Coated Aluminum Finish: ANSI 689, for door closers, magnetic holders, removable mullions, unless otherwise specified.
      d. Thresholds and Weatherseal: Thresholds, mill aluminum finish. Weatherseal, clear anodized aluminum finish.

S. Door Hardware Standards
   1. City of Fort Collins uses Allegion, Mountain States Sales Office for all specifications for Finish Hardware products. Please contact Timothy Slaughter, Allegion Sales Consultant @ (303) 909-3146 for assistance with all specification requirements at this facility.
      a. Key System: Schlage Primus FSIC Key System, integrate into existing system as directed by Owner.
      b. Cylindrical Locksets: Schlage ND Series, Rhodes Lever in 626 finish. For existing buildings, match existing building standards as specified by Owner.
      c. Panic Exit Devices: Von Duprin Rim devices in US26D finish. Provide 990 trim at exterior doors and lever trim 996 lever trim at interior doors. Unless otherwise specified, provide

rim devices with keyed removable mullions at paired openings. Where vertical rod devices are required, use less bottom rod – Owner to review and approve. Provide QEL with LX-RX monitor switch options at electrified openings. Provide cylinder dogging at non fire rated devices unless directed otherwise.

d. Electric Strikes: Von Duprin 5000/6000 Series as required by locking hardware.
e. Mullions: Von Duprin- KR 4954/ 9954 key removable steel, for fire rated and non-rated doors. Mullion storage devices, MT54. Install as directed by Owner.
f. Flush Bolts: Avoid automatic flush bolts and coordinators where possible. Owner to review and approve. Provide manual flush bolts at storage room doors and utility closets only.
g. Surface Closers: LCN- 4040XP Series Door Closer. Provide EDA Arm at high use openings. All closers to have ST-3596 special template for screw on cover.
h. Automatic Operators: LCN 9500 "Senior Swing," as directed by Owner. All push-button Actuators to be hardwired, 8310-853T/8310-855 or similar as required. Coordinate automatic operator installation with electrical and security contractors.
i. Continuous Hinges: IVES 112HD Series, full mortise geared hinge for use at Aluminum Storefront doors. Owner to review and approve.
j. Hinges: Ives heavy weight ball bearing hinges or standard weight hinges as required in 652 finish at interior doors, 630 finish at exterior doors. Provide Heavy weight hinges at main entry, exterior or high use doors.
k. Overhead Stops: Glynn-Johnson surface mounted overhead stops or holders in 630 finish when required.
l. Floor Stops: Ives heavy duty floor mounted Stops at all exterior doors and physical education areas.
m. Wall Stops: Ives convex or concave wall stops in 626 finish as required.
n. Kick Plates: Ives 10-inch-high, heavy duty steel kick plates as required.
o. Door Seals & Thresholds: Zero Products - as required. 655A Thresholds, 429A Weather Seal Exterior Doors, 188S/488S Smoke Seal, 8780N Mullion Seal, 39A or 8198AA Door Sweeps, 44SP Flat Astragal, 328AA meeting style Astragal, 142A Drip Guard.
p. Doors & Frames: Steelcraft exterior frames shall be fourteen (14) gauge with sixteen (16) gauge doors. Interior Frames shall be sixteen (16) gauge with eighteen (18) gauge doors. Exposed seam, zinc-iron, alloy-coated, galvannealed steel with closed tops at exterior doors. Door faces must be reinforced and sound deadened with ninety-nine (99) pounds, impregnated Kraft honeycomb core. All doors must also include a minimum seven (7) gauge hinge reinforcement, lock and exit device reinforcement and fourteen (14) gauge, twenty (20) inches long, closer reinforcement. Door must be provided in primed finish.
q. Access Control: ESI Security Integrator, consult with Owner. Continental head-end system.

PART 3 – EXECUTION

3.01 PREPARATION

A. Examine substrates to which hardware assemblies attach to hollow metal frames, doors and walls, with installer present, for compliance with requirements for installation tolerances, blocking and other conditions affecting performance of assemblies specified in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Any unique situations or struggle to meet the following standards shall be communicated to Owner for clarification and final decision. Whole hardware sets for each opening should be consulted before install to verify whether or not special templates must be followed to fix hardware conflictions. In conjunction with these standards, a preinstall meeting shall be held to streamline expectations. A final walk-through will be performed upon project completion to verify conformity to these standards.
B. Mount hardware according to applicable current publications.
C. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work. Do not install surface-mounted items until finishes have been completed on the substrates involved.
D. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
F. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.
G. Where hardware is replaced/upgraded on any existing door or frame, any hole/hardware preps left exposed from work performed must be filled and finished to original appearance.
    1. Holes left in wood doors must be filled with through bolts and a fastener with a finish washer. Through bolt screws and washers shall match hardware on existing door. Also acceptable is wood filled holes that are sanded and finished to match existing veneer; this match must be approved by Owner.
    2. All holes in existing hollow metal must be welded/bonded, sanded smooth, and repainted to match existing paint.
    3. If cover plates are used to cover hardware preps left exposed, screw heads and any edge gaps must be bonded to eliminate sight of screw head and gaps then painted to match existing paint.

3.03 CLEANING AND PROTECTION

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit.
    1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
B. All doors shall be protected from damage during construction. If work is going on inside of room/area and equipment is being moved in and out of opening, the doors shall be removed or protected in such a manner as to preserve original condition. Any damage to doors must be repaired and doors refinished to match factory finish prior to damage.
C. Existing and new doors must be cleaned thoroughly after completion of work to match original or factory cleanliness.
D. Six (6) Month Adjustment: Approximately six (6) months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following work:
    1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.

2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
4. Manufacturer’s representatives for, locksets, cylinders, exit devices and door closers, are to inspect and approve, in writing, certification that items have been properly installed and are functioning in accordance with manufacturer’s recommended installation procedures after installation. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

END OF SECTION 08 70 00

08 80 00 – GLAZING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for glazing.
   1. Glass and glazing for:
      a. Steel frames and doors.
      b. Wood doors.
      c. Aluminum storefront.
      d. Glazed aluminum curtain wall.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Samples.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Glazing for aluminum storefront and aluminum curtain wall shall be purchased from one manufacturer having single source responsibility. Glazing for wood windows shall be purchased from one manufacturer having single source responsibility. Aluminum storefront / curtain wall glazing manufacturer may be different from wood window glazing manufacturer.

2.02 PRODUCTS

A. Conform to all applicable requirements of “Glazing Manual” published by the Flat Glass Marketing Association, Topeka, Kansas.

B. Labels: Every individual piece of glass shall bear a label designating type, thickness and quality. Do not remove labels until inspected.

C. Insulated Glass Units: Sealed double pane units with capillary tubes. Units shall conform to ASTM E-774 (Specification for Sealed Insulated Glass Units) and ASTM C-1036 (Standard Specification for Flat Glass). Silicone edge seal. Purge inner pane space with hermetic air. Units shall have internal spacers at muntins to simulate true divided lites.
   1. Glass shall be tempered where required by Code, based on area and where required to meet the specified performance criteria. Glass shall be tempered also where requested by Owner.
   2. Glazing shall be factory installed.
   3. Once window units are installed in the building, the capillary tubes of the glazing units shall be sealed.
   4. Exterior Glazing Stops: Aluminum to match windows, sloped for wash. Form weather stop flange.
   5. Interior Glazing Stops: Wood or metal, to match location criteria.

D. Low E Glazing Required: Thermal performance and visible light transmittance to be approved by Owner.

E. Annealed Glass:

1. Annealed Clear (AC): ASTM C1036, Type I, transparent flat, Class 1 clear, Quality q3 glazing select, minimum thickness one-quarter (¼) inch.
2. Safety Glass (SG): Conform to ANSI Z97.1, minimum thickness one-quarter (¼) inch unless noted otherwise. Glass shall be tempered where required by the IBC, based on area. ASTM C1048, Kind FT Fully tempered, Condition A, uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.

F. Laminated Annealed Clear (LAC) ASTM C1172, with plastic interlayer.
   1. Plastic Interlayer: Manufacturer's standard, one-eighth (1/8) inch made up of two (2) one-sixteenth (1/16) inch panes, plus plastic interlayer.
   2. Special Application: Acoustical.

G. Safety Glass shall conform to the following: Safety plate glass to ANSI, minimum one-quarter (¼) inch. Use either fully tempered or laminated, minimum thickness of vinyl 0.015-inch.

H. Use double or triple glazing when necessary to provide consistent "R" ratings for energy efficiency and to prevent undesirable condensation.

I. Fire Rated Glazing (FRG): Sixty (60) and ninety (90) minute ratings, premium (polished) finish, as appropriate. Provide types and thicknesses required to achieve ratings.

J. Glazing Materials:
   1. Elastic Glazing Compound: Comply with Federal Specification TT-P-781a, Type I or TT-G-410e. Glazing compound shall be paintable.
   2. Setting Blocks, Shims and Glazing Clips: Size and type as recommended by glass manufacturer.
   3. Silicone Glazing Sealant: GE Silglaze N, Dow Corning 999, clear, or approved equal.
   4. Glazing Tape: DAP "Twin-T Mastic" Glazing Tape, one-sixteenth (1/16) inch thick; "Weatherban" 1202 Ribbon Sealer, one-sixteenth (1/16) inch-thick width, or approved equal.

PART 3 – EXECUTION

3.01 PREPARATION

A. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

END OF SECTION 08 80 00

08 83 00 – MIRRORS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for mirrors. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 WEIGHT ROOMS, DANCE/AEROBICS AREAS AND OTHER AREAS OF POTENTIAL IMPACT

A. Provide one-quarter (¼) inch thick tempered glass or plexiglass mirror backing safety film tape for full coverage to backside of mirror, designed to pass Category II mirror shatter-proofing on both vision and tape sides, frameless. Must be shatterproof and distortion-free.

2.02 RESTROOM MIRRORS

A. One-quarter (¼) inch thick, mirror glazing quality, polished plate with polished edges, frameless.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all mirrors with manufacturer's recommended method, including adhesive, screws, brackets and channels.

END OF SECTION 08 83 00

DIVISION 09: Finishes

09 05 00 – COMMON WORK RESULTS FOR FINISHES

5/25

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for finishes. Additional requirements may be included within specific agreements or other contracting documents.

1.03 ATTIC STOCK

A. Contractor shall turn over a minimum of two percent (2%) or one full carton whichever is greater to the Owner for future use.

1.04 REGULATORY REQUIREMENTS

A. Observe environmental precautions based on conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 09 05 00

09 29 00 – GYPSUM BOARD

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for gypsum board. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Work in this section is open to approved product or material meeting the standards listed in Section 01 61 00 – Common Product Requirements.

B. Where fire resistance classification is required, provide materials and application method according to those listed by UL for type of construction.

PART 2 – PRODUCTS

2.01 GYPSUM BOARD

A. Five-eighths (5/8) inch thick (one-half (½) inch thick in locations approved by Owner) type X, four (4) feet wide maximum available length in place; tapered edges:

1. Standard Type: Interior walls and ceilings where extra resistance from fire or moisture are not primary.
2. Fire Rated Type: Fire resistive, moisture resistant, UL or WH rated- walls and ceilings with major risk of catching fire and increased temperatures, such as fire escape stairs, elevators and laboratories.
3. Moisture Resistant Type: Walls and ceilings in areas with high humidity or water exposure.
4. Exterior Gypsum Soffit Board.
5. Cementitious Backing Board: High density, glass fiber reinforced, one-half (½) inch-thick with coated glass fiber tape for joints – all walls to receive tile.
6. Abuse-Resistant Gypsum Board: Fire rated type, gypsum core with abrasion resistant finish paper or fiberglass mat to resist surface-level abrasion and scratching caused by high traffic in standard use and indentations from low-energy or occasional impacts – hallway, classroom/daycare centers, healthcare areas, recreation areas.
7. Impact Resistant Gypsum Board: Fire rated, gypsum core with abrasion finish paper or fiberglass mat and mesh panel inside board to resist damage from high-energy or continual impacts that may break into the stud cavity – corridors, mail rooms, loading docks, gymnasiums, garages, stairwells.
8. Gypsum Wall and Soffit Sheathing: Moisture resistant, one-half (½) inch thick, four (4) feet by eight (8) feet sized sheets, square edges, water repellent paper faces.
9. Glass Mat Gypsum Sheathing Board: Non-structural, glass mat embedded, water resistant gypsum core panel.
10. Install control joints at stud walls perpendicular to exterior walls located on slabs on grade with independent foundations.
11. All gypsum board assembly products shall be formaldehyde-free.

2.02 ACCESSORIES

A. Acoustic Insulation: Preformed glass fiber, friction fit type, unfaced, four (4) inches thick.

B. Acoustic Sealant: Non-drying, non-hardening, non-skinning, non-staining, non-bleeding gunnable type for use in conjunction with gypsum board as recommended by the gypsum board manufacturer.
C. Corner Beads and Edge Trim: Metal.
D. Control Joints: Interior and exterior, as mandated by US Gypsum Association.
E. Joint Materials: Reinforcing tape, joint compound, adhesive, and water.
    1. Reinforcing Tape: Sheetrock Joint Tape. Paper, fiberglass joint tape not permitted.
    2. Joint-Treatment Materials: Lime compound. All-purpose joint and texturing compound containing inert fillers and natural binders. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Acoustic Accessories:
    1. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
    2. Install sill sealer under all partitions with acoustic insulation.
    3. Install resilient channels at maximum one (1) foot, four (4) inches o.c. Locate joints over framing members.
B. Gypsum Board:
    1. Building must be made waterproof, including window installation prior to bringing drywall into the building.
    2. Fasten gypsum board to furring or framing with screws spaced per IBC requirements.
    3. Place control joints at a maximum of thirty (30) feet o.c. in long horizontal or vertical surfaces. Place at point of maximum stress due to openings, deflection or other movement in structure. Break framing behind control joints.
    4. Seal joints where stud partitions meet floors, ceilings and walls. In STC rated acoustic walls, between metal stud track/runner and adjacent construction and between devices and gypsum board, apply acoustical sealant. Apply sill sealer under runners.
    5. Fasten gypsum sheathing to steel studs with approved fasteners at six (6) inches o.c. along panel edges and one (1) foot o.c. in field.
    6. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
    7. Seal cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.
    8. Install cementitious backing board in wet areas behind ceramic tile. Fasten to steel studs with approved fasteners at six (6) inches o.c. along panel edges and one (1) foot o.c. in field.
C. Joint Treatment:
    1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
    2. Use the three coat and plaster method minimum.
    3. Feather coats onto adjoining surfaces so camber is maximum one-thirty-second (1/32) inch.
    4. Fill and finish joints and corners of cementitious backing board.
    5. Note: No tape at exterior gypsum sheathing that receives Spray Foam Insulation.
D. Finish: Level 4 with “Light Orange Peel” texture, or unless noted otherwise.

E. Tolerances: Maximum Variation from Flat Surface: One-eighth (1/8) inch in ten (10) feet nor vary at a rate greater than one-sixteenth (1/16) inch per foot in any direction.
F. Apply sealants only after gypsum board has been primed.
G. Guidelines and Requirements for Sound Insulating Partitions:
    1. Seal partitions airtight.
    2. Undercut/hold back final layer of gypsum board one-eighth (1/8) inch to one-quarter (¼) inch at perimeter and seal with acoustical caulk or sealant.
    3. Where multiple layers of gypsum board are indicated, stagger joints. When possible, mount the layer perpendicular to the proceeding layer.
    4. Avoid penetrations through sound insulating partitions whenever possible.
    5. Seal penetrations resiliently airtight around the penetrating item.
    6. The penetrating object shall not come into contact with the partition. All contact shall be resilient in nature.
    7. Pipes: Oversize the penetration and wrap the pipe with closed-cell pipe insulation. Seal all gaps with non-hardening acoustical sealant.
    8. Electrical: Back-to-back electrical boxes shall be staggered a minimum of twenty-four (24) inches, and within different stud-bays. Boxes shall be covered with sound putty pad.
    9. Ductwork: Seal all ducts that penetrate sound insulating partitions with non-hardening acoustical sealant.
    10. If the sound insulating capabilities of the partition are compromised by the penetration(s), it may be necessary to provide a chase wall around the penetrating object.
    11. Extend partitions and framing to underside of structure at secure areas and other areas requiring acoustical separation.

END OF SECTION 09 29 00

09 30 00 – TILING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for tiling.
  1. Ceramic, porcelain for interior floor, base and wall applications. In restrooms, locker rooms and shower areas.
  2. Ceramic tile for stairs.
  3. Ceramic tile accessories.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Comply to all standards of TCA on all installations.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.
- C. Samples: Provide actual physical samples for any material that requires selection of color or finish.
- D. Extra Material: Tile and trim units. Furnish quantity of full-size units equal to ten percent (10%) of amount installed, ten (10) pieces minimum for each type, composition, color, and size.

1.04 QUALITY ASSURANCE
- A. Qualifications
  1. Installer: Skilled and experienced Installer who has successfully completed tile installations similar in material, design, and extent.

PART 2 – PRODUCTS

2.01 TILE MATERIALS
- A. Products that best meet the sustainability preferences outlined in Section 01 61 00 shall be used in all areas.
  1. Provide only domestically manufactured tile products.
  2. Ceramic tile for floor and base is prohibited.

2.02 MORTAR BOND COAT MATERIALS
- A. Dry Set Latex Portland Cement Type: Portland cement, sand, water and additives required to meet specific installation conditions.

2.03 GROUT MATERIALS
- A. Grout must be as dark as possible. Owner to approve final color.
- B. Polymer fortified, sanded Portland cement grout.
- C. Epoxy Grout required for stairs, restrooms, locker rooms, and showers.

2.04 ACCESSORY MATERIALS
- A. Membranes: Install waterproofing and vapor-retardant sheet membranes in all wet areas. Provide uncoupling membranes to allow for crack-protection and isolation, and movement. Apply under floor tile where tile spans over control joints in concrete slab.
- B. Elastomeric Sealants: To be applied at all restroom walls, floors, shower surrounds and other areas exposed to moisture.

C. Metal Edge Protection Strips: Stainless steel, with integral provision for anchorage to substrate. Provide at all exposed ceramic tile edges and transitions and exterior corners.
D. Metal Stair Nosings: Stainless steel, slip resistant surface.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grout joint width one-eighth (1/8) inch or three-sixteenth (3/16) inch or as recommended by tile manufacturer.
B. All tiles are to the face on the same plane unless special installation is approved.
C. Wall tile on walls with plumbing to run full height. Other walls can be full height or wainscot, with approval from Owner.
D. Floor tile to slope to floor drain only with Owner approval. Floor tile can be laid flush to drain.
E. Sound tile after setting. Replace hollow sounding units.
F. Keep expansion and control joints free of adhesive or grout. Apply sealant to joints. Install membrane at control joints and locate control joints in tile at the grout joint nearest the slab control joint. Leave approximately one-eighth (1/8) inch gap where floor tile abuts perimeter walls; gap will be concealed by coved tile base or metal cove.
G. Grout Tile Joints. Fill joints full to eliminate tile edges that can act as a "squeegee" during floor cleaning. Joints shall be shallow concave shape. Grout color shall be consistent. Avoid light color grout in floor tile and base.
H. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
I. Apply grout sealer after set time recommended by manufacturer, but in no case less than three (3) days after placement of grout. Do not apply sealer on epoxy grout.

3.02 FLOORS – THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA, dry-set or latex-Portland cement bond coat, with standard grout.
B. In kitchen, toilets, and locker rooms, install in accordance with TCA.
C. Where epoxy grout is required, but not epoxy bond coat, install in accordance with TCA.
D. White or light tile not permitted on floor or stair surfaces, unless approved by Owner.

3.03 WALL TILE

A. Over cementitious backer units install in accordance with TCA, using membrane at toilet rooms, kitchens and locker rooms and other areas exposed to moisture.
B. Over gypsum wallboard on metal studs install in accordance with TCA, thin-set with dry-set or latex-Portland cement bond coat.
C. Over interior concrete and masonry install in accordance with TCA, thin-set with dry-set or latex-Portland cement bond coat.

END OF SECTION 09 30 00

09 51 00 – ACOUSTICAL CEILINGS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for acoustical ceilings. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE
- A. Installer: Company specializing in performing Work of this section with minimum three (3) years' experience approved by manufacturer.
- B. Tolerances: Variation from flat and level surface, one-eighth (1/8) inch in ten (10) feet and not vary more than one-sixth (1/6) inch in any direction.
- A. Extra Stock: Contractor shall turn over a minimum of two percent (2%) or one full carton whichever is greater to the Owner for future use.

PART 2 – EXECUTION

2.01 SYSTEM DESCRIPTION
- A. Use bio-based/rapidly renewable acoustic panels where feasible.

2.02 COMPONENTS
- A. Non-Fire Rated Grid: Intermediate duty, exposed T configuration; components die cut and interlocking, compressed mineral fiber, five-eighth (5/8) thickness, minimum.
- B. Accessories: Stabilizer bars, clips, splices, edge moldings, hold down clips, and extended leg drapery pocket angles required for suspended grid system.
- C. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- D. Exposed Grid Surface Width: Fifteen-sixteenth (15/16) inch.
- E. Grid Finish: White color.
- F. Support Channels and Hangers: Galvanized steel, size and type to suit application and ceiling system flatness requirements specified.
- G. Preformed grid intersections/corners at bull nosed wall corners.
- H. Miter Corners.
- I. Texture: Non-directional deep fissure, white.
- J. Impact resistant coating in high use areas. Mylar, vinyl or impervious finish required at food service areas.
- K. STC Rating: Thirty-five (35) to thirty-nine (39) required in assignable spaces only.
- L. Light Reflectance: 0.075 minimum.
- M. Materials: Class A, Fire rated as required by code.
- N. Lay-in ceilings are prohibited in the following locations: locker rooms, toilet rooms, stairways, storage areas, exterior soffits, utility rooms (boiler, chiller and electrical).
- O. Use of wood, metal, decorative panels, luminous or other ceiling types to be approved by Owner.

2.03 ACOUSTIC PANELS

A. Two (2) feet by four (4) feet or two (2) feet by two (2) feet by five-eighth (5/8) inch, mineral fiber, white, minimum forty-five (45%) pre-consumer recycled content square edge. NRC 0.70, 0.80 reflectance, Class A, CAC 35, non-directional fissured panel.
B. Two (2) feet by four (4) feet by five-eighth (5/8) inch, white vinyl faced gypsum panels, CAC 45-49, square edge.

2.04 CEMENTITIOUS WOOD FIBER TILE

A. Sound absorbing panel made from bonded wood fibers with cement binder, natural or painted finish. NRC up to 1, natural or painted finish.
   1. Thickness: One and one-half (1½) inches.
   2. Panel Dimensions: Five (5) feet wide by five (5) feet long.
   3. Form: Tile with square edges.
   4. Finish: Factory finish or paint as specified.
   5. Attachment:
      a. Anchorage: Size fourteen (14) screws with a two (2) inch washer sufficient to penetrate one (1) inch in steel deck.
      b. Screws and washer color: To match finish.

2.05 ACCESSORIES

A. Acoustic Batt Insulation: Friction fit type, unfaced; two (2) inch thick.
B. Gypsum Board: Fire rated type, five-eighth (5/8) inch thick, paper faced.
C. Impaction (Hold Down/Panel Retention) clips, spring assembly.

PART 3 – EXECUTION

3.02 INSTALLATION

A. Suspension System:
   1. Coordinate location of hangers with other work. Where components prevent regular spacing of hangers, reinforce system to span extra distance.
   2. Hang system independent of walls, columns, ducts, pipes and conduit.
   3. Locate system on room axis according to reflected plan.
   4. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths.
   5. Hanger wires shall be placed at all four corners of lay-in light fixtures and elsewhere to support imposed loads. Maximum grid deflection: One-three hundred-sixtieth (1/360) of longest room dimension.
   6. Impaction clips. Spring assembly.
   7. Where ceilings abut glazed openings, use extended leg drapery pocket angles.
   8. Coordinate with expansion joint cover assemblies.
   9. Attach ceiling suspension system to structural members, attachment to steel deck is prohibited.

END OF SECTION 09 51 00

09 60 00 – FLOORING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for flooring. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Obtain flooring (of each type) from a single manufacturer or source, manufacturer, including recommended primers, adhesives, sealants, bond coat ingredients, additives, and leveling compounds, to ensure match of quality, color, pattern and texture.

B. Five (5) years minimum experience in similar material installation and/or certified by manufacturer – unless otherwise indicated.

C. At movable partitions, install flooring under partitions without interrupting floor pattern.

D. Provide cleaning instructions for all types of flooring, using products recommended by manufacturer.

E. Ceramic and porcelain tile to comply to all standards of TCA.

F. All flooring types to be approved by Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 09 60 00

09 64 00 – WOOD FLOORING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for wood flooring.
  1. Gymnasium flooring.
  2. Main and forestage flooring.
  3. Specialty flooring.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Final acceptance of adequacy of proposed product shall be determined by Owner.
- D. Provide all flooring, installation products and accessories from a single source for each product specified.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings: Colors and locations of game lines, logos and markers.
- B. Samples.
- C. Attic Stock: Provide two percent (2%) of extra materials to Owner for future use and repairs.

1.04 QUALITY ASSURANCE
- A. Installer will have a minimum of five (5) years' experience in Colorado on installations of similar size and complexity
- B. Preference for products produced in USA.

PART 2 – PRODUCTS

2.01 WOOD GYMNASIUM FLOOR SYSTEM
- A. Maple flooring: Twenty-five-thirty-seconds (25/32) inch thick by two and one-quarter (2¼) inch wide, Second and better grade, tongue and groove, end matched, kiln-dried, Northern Hard Maple, graded in accordance with MFMA standards and grade marked and stamped by an MFMA manufacturer.
- B. Sleepers with resilient pads, vapor barrier and all accessories recommended by system manufacturer.
- C. Fasteners: Barbed cleats or coated staples.
- D. Perimeter Vented Base: Three (3) inch by four (4) inch vented vinyl or rubber L-shaped base with pre-molded outside corners and mitered inside corners.
- E. Aluminum thresholds at all door openings.
- F. VOC compliant finish materials, approved by MFMA and manufacturer.
- G. Game line paint as recommended by gymnasium flooring manufacturer.
- H. Protect wood flooring during the remainder of the construction period.
- I. Provide one (1) year warranty for defects in materials and workmanship.

2.02 STAGE FLOORING
- A. Wood strip wood flooring on sleepers and plywood subfloor with vapor retarder, sanding, sealers, finishes and wall base.

B. Twenty-five-thirty-seconds (25/32) inch thick by two and one-quarter (2¼) inch wide, second and better grade, tongue and groove.
C. MFMA Maple or quarter sawn Oak, lengths two (2) feet and up, average length of four (4) feet, one-quarter (¼) inch.
D. Apply wood stain and penetrating clear sealer.
E. Perimeter vented base: Three (3) inch by four (4) inch vented vinyl or rubber base.

2.03 SPECIALTY FLOORING

A. Dance/multi-purpose permanently installed sprung floor system over subfloor consisting of dual-layer subsurface panel over dual-layered suspension panel.
B. Not less than fifty-nine (59%) average shock absorption.
C. Hardwood finish, two and one-quarter (2¼) inch thick on dual-layer, semi-flexible suspension panels and cellular polyurethane core over damp-proof membrane.
D. Condition floor prior to installation per manufacturer's instructions.

2.04 ACCESSORIES

A. Sub-floor filler, adhesives, primers, sealers and underlayment shall be approved by product manufacturer and appropriate for substrate.

PART 3 – EXECUTION

3.01 PREPARATION

A. Wood flooring bundles shall be opened and spread out to acclimatize in the space where it is to be located seven (7) days prior to installation (or per manufacturer's instruction), in dry, warm, weather tight and well-ventilated conditions and according to manufacturer's suggested procedure.

3.02 INSTALLATION

A. Slab or existing floor must be smooth and dry before any installation.

3.03 TESTING

A. Provide slab moisture tests prior to specifying resilient flooring to ensure that the proper adhesive is specified. Select adhesive according to results of moisture testing. Moisture test is required immediately prior to installation of any product.

END OF SECTION 09 64 00

09 65 00 – RESILIENT FLOORING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for resilient flooring.
  1. Resilient base and accessories.
  2. Resilient tile flooring.
  3. Resilient athletic flooring.
  4. Specialty flooring.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Final acceptance of adequacy of proposed product shall be determined by Owner.

1.03 SUBMITTALS REQUIRED
- A. Samples.

1.04 QUALITY ASSURANCE
- A. Qualifications
  1. Installer will have a minimum of five (5) years' experience on installations of similar size and complexity.
- B. Warranty
  1. All products shall have a minimum ten (10) year limited wear layer warranty.
- C. Preference for products produced in USA.

PART 2 – PRODUCTS

2.01 GENERAL
- A. Sub-floor filler, adhesives, primers, sealers and underlayment shall be approved by product manufacturer and appropriate for substrate.

2.02 RESILIENT BASE AND ACCESSORIES
- A. Rubber Base
  1. Rubber, top set coved, PVC free. No vinyl base. Other profiles accepted with Owner approval. Rolled goods only. Four (4) foot strips with Owner approval.
  2. Height: Four (4) inch or 4.25-inch in remodeled areas, six (6) inch as required.
  3. Thickness: 0.125-inch-thick.
  4. Finish: Matte.
  5. Color: Black, other colors to be approved by Owner.
  6. Apply top set cove base at all resilient flooring and carpet areas, unless matching existing wood base.
  7. Carpet base prohibited.
  8. Miter internal corners, external corners shall be job-formed, no joints within two feet of corner edge.
- B. Transition Accessories
  1. Rubber, PVC free.

2. Products include reducers, edge guards, transitions, cove caps and other items used to accommodate the transition from one type of flooring or material to another.
3. Color: Black preferred, other colors to be approved by Owner.
4. Metal floor transitions, reducers, saddles and thresholds are allowed with Owner approval.

C. Stair Treads and Risers
1. Rubber, PVC free.
2. One piece tread/risers, raised pattern.
3. Safety abrasive strips or rubber inserts at front edge of tread, contrasting color.
4. Rubber treads with Kevlar nosing required in high traffic areas.
5. Rubber stair nosing to be approved by Owner.
6. Concrete filled stair treads to have embedded, cast-in aluminum nosing with grit strip.

2.03 RESILIENT TILE FLOORING

A. Use of sheet flooring (non-athletic) or linoleum products not allowed by Owner.
B. Durability, field repairability and general maintenance are critical issues in the selection of flooring materials to be used in Owner buildings.
C. VCT: Not allowed unless patch and repair, matching existing in one space, with Owner approval.
D. LVT (Luxury Vinyl Tile)/LVP (Luxury Vinyl Plank)
1. Prohibited on ramps and sloped surfaces.
2. Discouraged use in large areas where dragging or moving equipment, chairs and tables may damage the wear surface.
3. Limit use of very light and very dark colors, utilize multi-colored and embossed textured patterns to reduce the visual appearance of scratches.
4. Minimum twenty-eight (28) MIL wear layer for any specified luxury vinyl tile. Less wear layer only with Owner approval.
5. Thickness: 2.5 millimeters minimum.
6. Square edge preferred.
7. Owner to review all LVT/LVP selections.

E. Rubber Tile
1. Stair landings where stair treads and risers are rubber.
2. Other areas with Owner approval.
3. Through color, slip resistant, no coating required, good for heavy traffic.
4. No solid colors.
5. Textured surface.

F. Quartz tile, HVT, Bio-based, textile-composite, flocked, and others to be reviewed and approved by Owner.

2.04 RESILIENT ATHLETIC FLOORING

A. Complete installation of synthetic sports surfacing system, including gymnasium sports game lines and logos.
1. Class 3 shock absorption, ball rebound ninety percent (90%), dual density foam backing with high density wear layer, resistance to rolling loads, no wax.
2. Heat welded, full spread adhesive coverage.
3. 0.03-inch overall thickness, 0.08-inch wear layer, glue down roll.
4. High density underlayment at bleacher areas.

B. Weight room flooring over concrete: Non-adhered/interlocking or adhered rubber tiles.
1. Anti-slip and anti-skid, wet or dry.
2. Non-porous and non-absorbent.
3. Anti-bacterial, mold and mildew resistant.
4. Vulcanized rubber, bevel at door thresholds.

5. Three-eighth (3/8) inch minimum thickness, sixty-four (64) pounds per cubic foot density.
6. Install crash pads at free-weight and weight machine areas.
7. Darker colors preferred.

C. Spike/Skate Blade Resistant Rubber Tiles: PVC free, three-eighth (3/8) inch thick, flecked pattern, with manufacturer's approved adhesive.
D. Vinyl Dance Floor: Loose lay or permanent installation, roll, two (2) millimeter thickness.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Slab or existing floor must be smooth and dry before any installation.
B. Provide all flooring, installation products and accessories from a single source for each product specified.

3.02 TESTING

A. Provide slab moisture tests prior to specifying resilient flooring to ensure that the proper adhesive is specified. Select adhesive according to results of moisture testing. Moisture test required immediately prior to installation of any product.

END OF SECTION 09 65 00

09 68 00 – CARPET

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for carpet.
  1. Modular carpet tile.
  2. Broadloom carpet.
  3. Walk-off carpet.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Final acceptance of adequacy of proposed product shall be determined by Owner.

1.03 SUBMITTALS REQUIRED
- A. Samples.
- B. Extra Stock:
  1. Minimum of one percent (1%) of installed material or as directed by City, packaged and identified.
  2. Contractor shall turn over five percent (5%) of each type of carpet and base installed to the Owner for future use and repairs. For carpets that have a range of colors, then four percent (4%) attic stock shall be required. All products to be labeled with product name and installation location.

1.04 RELATED SECTIONS
- A. 09 65 00 – Resilient Flooring and Accessories

1.05 QUALITY ASSURANCE
- A. Qualifications
  1. Installer will have a minimum of five (5) years' experience on installations of similar size and complexity.

PART 2 – PRODUCTS

2.01 GENERAL
- A. TARR durability ratings: >/+2.5 – light foot traffic, >/+3.0 – moderate foot traffic, >/= 3.5 high foot traffic.
- B. Provide Modular carpet, considering use requirements.

2.02 CARPET TILES AND BROADLOOM
- A. Carpeted steps and stair nosings are not allowed unless in low traffic areas where necessary for acoustical performance and approved by Owner. Broadloom carpet to be used on stairs meeting this criterion.
- B. Carpet in any contiguous area shall be from a single dye lot, visible differences in color shall be rejected.
- C. Carpet base is prohibited.
- D. All modular carpet to have a Lifetime Commercial Limited Warranty.
- E. All fiber to be cationic system, one hundred (100%) solution dyed, type 6 or 6.6, eighteen (18) ounces minimum.

2.03 WALK-OFF CARPET SYSTEM

A. Modular, one hundred (100%) solution dyed, thirty-six (36) ounces, 3.5 TARR rating.
B. Lifetime Limited Commercial Warranty.
C. Darker colors preferred.
D. Moisture barrier backing.
E. Must be installed with manufacturer's recommended adhesive.
F. Install walk-off material a minimum of fifteen (15) feet or as much as available space allows.
G. Install walk-off material at all exterior doors.

2.04 ACCESSORIES

A. Sub-floor filler, adhesives, primers, sealers and underlayment shall be approved by carpet manufacturer.
B. Direct glue down adhesive as recommended by carpet manufacturer. Products shall be low VOC.
C. Transitions, moldings, reducers and edge strips: Rubber, PVC free.
D. Moisture Barrier:
    1. Provide waterproof primers and adhesives as recommended by the manufacturer of the material being installed on suit material and substrate conditions. Use solvent free type.
    2. Adhesive to be moisture resistant material suitable for installation over slab on grade.
    3. Floor Filler: Latex and white silica sand. Use correct product for specific application thickness.
    4. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
    5. Leveling Compound: Latex type which can be feather edged, as recommended by flooring manufacturer, trowelable consistency for tapering where required.
    6. Provide sealer over subfloors.

PART 3 – EXECUTION

3.01 PREPARATION

A. Provide slab moisture tests prior to specifying carpet to ensure that the proper backing and adhesive is specified. Select backing and adhesive according to results of moisture testing.

3.02 INSTALLATION

A. Carpet shall be installed using manufacturer's recommended products.

END OF SECTION 09 68 00

09 80 00 – ACOUSTICAL TREATMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for acoustical treatment.
  1. Fabric covered acoustical wall panels.
  2. Fabric covered acoustical ceiling panels/baffles.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Final acceptance of adequacy of the proposed product shall be determined by the Owner.
- D. Acoustical Consultant to determine the specific requirements for acoustical treatment and panels.
- E. Absorptive wood panels and digital graphics to be approved by Owner.

1.03 SUBMITTALS REQUIRED
- A. Samples.

1.04 QUALITY ASSURANCE
- A. Installer will have a minimum of five (5) years' experience in Colorado on installations of similar size and complexity.
- B. Preference for products produced in USA.

PART 2 – PRODUCTS

2.01 FABRIC COVERED ACOUSTICAL WALL PANELS
- A. Core: Six (6) to seven (7) PCF fiberglass board, chemically hardened edges. Fabric is stretched over panel, wrapped and bonded around edges. Square edges preferred.
- B. Standard factory fabric, factory approved or customer-selected cover or vinyl.
- C. Z-clip attachment or adhesive.
- D. Class A rating.
- E. NRC rating, reverb times: dependent on panel thickness, installation space and Acoustical Consultant studies.
- F. Moisture resistant finishes for swimming pool/natatorium areas.
- G. For areas requiring greater durability: Six (6) to seven (7) PCF core with one-eighth (1/8) inch thick high density impact resistant skin laminated on the core face. Vinyl or fabric finish, Z-clip attachment.
- H. Panels can be tackable.

2.02 FABRIC COVERED ACOUSTICAL CEILING PANELS
- A. Ceiling Suspended Vertical Baffles and Clouds: NRC -0.08 TO 1.00 or per consultant recommendation. Six (6) to seven (7) PCF fiberglass boards, faced in standard factory fabric, factory approved or customer-selected cover. Chemically hardened edges, cloud suspension clips or adhesive.
- B. Class A rating.
- C. Mount per manufacturers' recommendations.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Acoustical panels shall be installed in spaces such as gyms, auditoriums, swimming pools and other large spaces to improve the acoustical performances of these areas.

END OF SECTION 09 80 00

09 90 00 – PAINTS AND COATINGS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for paints and coatings.
   1. Surface preparation and field application of paints, transparent finishes, and other coatings.
   2. Painting of exterior prefinished speaker enclosures, interior prefinished mechanical grilles and other prefinished items to match adjacent finished surfaces.
   3. Sealants around finish carpentry and casework.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Color Schedule: Upon project completion provide Owner with complete schedule of colors, locations and formulas.

B. Drawdowns: Provide drawdowns of each color specified.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified with a minimum of three (3) years' experience and with facilities within one hundred (100) miles of Project.
   2. Installer: Company specializing in performing Work of this section with minimum three (3) years' experience approved by manufacturer.

B. Mock-up required.

C. Standards
   1. Work shall conform to Type I Quality at a minimum.
   2. Proper removal of any flaking lead paint shall be in accordance with federal abatement laws.

D. Mixing and application of paint materials shall be performed only by qualified journeyman painters.
   1. Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

E. Extra Stock
   1. Extra Paint: To be determined per project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original containers with seals unbroken and labels intact.

B. All containers shall bear manufacturer's name, label, and the following:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. Standard colors to be selected from manufacturers full line.
B. VOC emissions must not exceed the VOC and chemical component limits of Green Seal's standard GS-11 requirements.
C. Satin or eggshell for all interior wall finishes.
D. Semi-gloss to be used in restrooms, hollow metal door frames and other areas per industry standard or Owner's request.
E. Restrooms, locker rooms, kitchens, custodial rooms and other "wet" areas to receive a water-based epoxy finish. Doors and door frames in similar locations to receive a water-based epoxy finish or other chemical/resilient door and door frame assembly.
F. Quality: All products not specified by name shall be "best grade" or "first line" products of acceptable manufacturers. Where possible, materials shall be of a single manufacturer.
G. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials required to achieve the finishes specified.
H. All new buildings, expansions and major renovations to receive Level 4 drywall finish with eggshell sheen.
I. Textured, faux or multi-color interior finish paints and coatings are not permitted.

2.02 COLORS

A. Minimize number of colors within a facility to provide better maintenance. Continuous palettes per building not per space.
B. Primary color to be selected from the approved City palette. Color to be approved by Owner.
C. Accent colors must be approved as a part of the building colors. To request a variance, contact the Owner.
D. Accent colors for offices or workspaces can only be applied to one wall.
E. Color selections should run continuously through building and not be different for every space.
    1. Custom colors are not allowed unless to match existing paint color.
    2. White Board paint and Chalk Board paint are not allowed.

PART 3 – EXECUTION

3.01 PREPARATION

A. Provide barrier coats over incompatible primers or remove and re-prime or sand or wire brush irremovable primer as required to achieve proper bond between primer and finish coat.
B. Sand finishes on wood and metal surfaces between coats to assure smoothness and adhesion of subsequent coats. Use extra fine sandpaper to avoid cutting the edges when sanding. Apply putty or spackling compound after surfaces are primed and primer is dry. Bring material flush with adjoining surfaces.
C. Surfaces shall be perfectly dry, clean and smooth before starting work. Fill cracks, holes or checks full and make smooth before finish is applied to surfaces. Fill any cracks, etc., which occur after walls are sized.
D. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or applying finishes.
E. Have as much furniture removed or away from walls as possible.
F. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

H. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove foreign matter. Remove oil and grease with solution of tri-sodium phosphate, rinse well and allow to dry.
I. Uncoated Steel and Iron Surfaces: Remove scale by wire brushing, sandblasting, and clean by washing with solvent. Apply treatment of phosphoric acid solution. Prime paint after repairs.
J. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Clean surfaces with solvent. Prime steel surfaces exposed by preparation activities with primer similar to existing.
K. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections. Fill nail holes and cracks after primer has dried; sand between coats.
L. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Sand prior to first coat to provide uniform natural finish. Fill nail holes and cracks after first coat of sealer has dried using a filler compatible with finish system and matching color; sand lightly between coats.
M. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable sealant after prime coat has been applied.
N. Furnish and lay drop cloths or mask off areas where finishing is being done to protect floors and other work from damage during the execution of work. Where it becomes necessary to remove temporary coverings placed by others, replace same in proper manner. Remove oily rags and waste from the building every night. Do not allow to accumulate
O. Be responsible for any damage done to the work of other trades. Replace any materials damaged to such an extent that they cannot be restored to their original condition.
P. Beginning of application means acceptance of existing surfaces.
Q. Measure moisture content of porous surfaces using electronic moisture meter. Do not apply finishes unless moisture content is less than twelve percent (12%).
R. Clean up entire space upon completion of project.

3.02 INSTALLATION

A. Workmanship
    1. Block Fillers: Ensure complete coverage with pores and pinholes filled. Two (2) coats minimum.
    2. Prime Coats: Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
    3. Pigmented (Opaque) Finishes: Completely cover surfaces to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
    4. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
    5. Provide satin finish for final coats.
    6. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
B. Application
    1. Sand wood and metal surfaces lightly between coats to achieve the required finish.

2. Where clear finishes are required, tint fillers to match wood.
3. Prime concealed surfaces of interior and exterior woodwork with primer paint.
4. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced twenty-five percent (25%) with thinner.
5. Roller Applied: Where paint or enamel is rolled on, use a fine nap roller so an orange peel texture is obtained.
6. Finishing Mechanical and Electrical Equipment:
    a. Color code items in accordance with specified requirements. Color band and identify with flow arrows, names, and numbering.
    b. Paint shop primed equipment.
    c. Remove unfinished louvers, grilles, covers, and access panels and paint separately. Paint dampers exposed behind louvers, grilles, convector and baseboard cabinets to match face panels.
    d. Prime and paint insulated and exposed pipes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished to match surface on which installed.
    e. Paint interior surface of air ducts and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    f. Paint exposed conduit and electrical equipment occurring in finished areas to match surface on which installed.
    g. Paint both sides and edges of plywood backboards to match surface on which installed.
    h. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
    i. All fire sprinkler risers shall be painted red.
    j. Paint exterior prefinished speaker enclosures to match adjacent finished materials.
    k. Paint interior prefinished mechanical grilles and other prefinished items to match adjacent finished surfaces.
7. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, providing sufficient differences in shade of undercoats to distinguish each separate coat.
8. Avoid the use of dark colors on exterior hollow metal doors.

C. Painting Schedule
1. Exterior Surfaces:
    a. Ferrous metals, including areas on the roof not visible from ground. First coat not required on items with prime coat applied by manufacturer. Satin Latex Enamel: Two (2) finish coats over primer.
        i. Primer: Synthetic rust-inhibiting primer, total dry film thickness of not less than 1.4 MILs.
        ii. First and Second Coats: Satin latex enamel, total dry film thickness of not less than 2.8 MILs.
    b. Zinc coated metals (Galvanized) including areas on roof not visible from ground. Semi-gloss enamel, two (2) finish coats over primer.
        i. Primer: Galvanized metal primer, total dry film thickness not less than 2.5 MILs.
        ii. First and Second Coats: Satin latex enamel, total dry film thickness not less than 2.8 MILs.
        iii. Wood – Transparent:
            1. Water base spar urethane.

2. Interior Surfaces:
    a. Accent walls must only be one wall per space. Accent colors can only be selected from the approved building color palette. Contact the Owner for additional information.
    b. Concrete Block – Flat Latex Enamel Finish: Two finish coats over an undercoat and a filled surface.
        i. Test surfaces for alkalinity with pink litmus paper or other recognized method.
        ii. Where extreme alkalinity occurs, wash surface with four percent (4%) solution tetra potassium pyrophosphate (five (5) ounces per gallon of water) where latex-based paint is to be used and with zinc sulfate solution (three (3) pounds per gallon of water) where other paint bases are to be used.
        iii. Etch normal concrete surface to receive alkyd paint with muriatic acid solution (one (1) part commercial 31.45 percent with three (3) parts water).
        iv. Block Filler: High performance latex-based block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness not less than 5.0 MILs. Apply in two coats to permit identification and correction of CMU surface irregularities, pinholes not filled and the like after the first coat.
        v. First and Second Coats: Interior, semi-gloss, total dry film thickness of not less than 3.2 MILs.
        vi. Epoxy Emulsion Coating: Provide one coat primer as recommended by coating manufacturer and two finish coats epoxy emulsion.
            1. Bond primer white, interior latex based primer.
            2. First and Second Coats: Epoxy emulsion, semi-gloss finish.
    c. Gypsum Board:
        i. Primer: White, interior, latex-based primer, total dry film thickness not less than 1.2 MILs.
        ii. First and Second Coats: Typical walls use satin; high use walls use semi-gloss enamel, total dry film thickness not less than 3.2 MILs. Verify with Owner.
        iii. One (1) coat Polyurethane thinned, one (1) pint of thinner per gallon.
        iv. Tw (2) coats Polyurethane Varnish.
        v. Sand between each coat.
    d. Woodwork and Hardboard (Opaque Finish):
        i. Primer: Low luster, acrylic latex, total dry film thickness of not less than 1.4 MILs.
        ii. First and Second Coats: Low luster, acrylic latex enamel, total dry film thickness of not less than 2.8 MILs.
    e. Exposed Metal Decking and Framing (Dry Fall):
        i. First Coat: Flat, acrylic primer, total dry film thickness of not less than 2.5 MILs.
        ii. Second Coat: Flat, acrylic dryfall, total dry film thickness of not less than 3 MILs.
    f. Epoxy Emulsion Coating: Provide one coat primer as recommended by coating manufacturer and two (2) finish coats epoxy emulsion.
        i. Bond Coat: Primer White, Interior Latex Based Primer.
        ii. First and Second Coats: Epoxy Emulsion, flat finish.
    g. Zinc Coated Metal (Galvanized): Satin latex enamel finish, two (2) finish coats over a primer.
        i. Primer: Galvanized metal primer, total dry film thickness of not less than 2.5 MILs.
        ii. First and Second Coats: Exterior, semi-gloss, latex enamel, total dry film thickness of not less than 3.2 MILs.
    h. Ferrous Metal: Satin latex enamel finish, two (2) coats over a primer.

i. Primer: Synthetic, quick-drying, rust-inhibiting primer, total dry film thickness of not less than 1.5 MILs.
ii. First and Second Coats: Exterior, semi-gloss, latex enamel, total dry film thickness of not less 3.2 MILs.

i. Interior Wood (Transparent Finish):
i. Oil based stain to achieve color.

D. Sealants
1. Provide and Install:
a. At joint between countertop and backsplash.
b. At joint between countertop/backsplash and wall.
c. At joint between exposed cabinet side and wall.
d. Around windows and sills.

E. Miscellaneous Requirements
1. Remove all finish hardware, electric plates and accessories. Mask any that are not removable.
2. Mechanical and Piping and Ductwork: Wherever uninsulated piping or ductwork occurs in rooms where walls are finished or elsewhere as called for, finish pipes as called for under ferrous zinc coated, or factory primed metals. Exposed ductwork shall not be painted. Exposed fire sprinkler piping shall be painted gloss red.
3. Grilles, Registers and Louvers: They shall be spray painted, thoroughly covering all surfaces visible through grille after installation, and returned to the supplier for installation. After installation, do such touch up of screws and scuffed spots or repainting as required to achieve a uniform paint job.
4. Electrical Surface Raceway: Paint to match wall on which installed.

3.03 CLEANING AND PROTECTION

A. Protection
1. Provide metal pans or adequate tarpaulins to protect floors in areas assigned for the storage and mixing of paints.
2. Use sufficient drop cloths and protective covering for the full protection of floors, furnishings, and work not being painted.
3. Provide “Wet Paint” signs to protect newly painted finishes. Remove temporary protective wrappings on work of other trades after completing painting operations.
4. Keep waste rags in metal drums containing water and remove from building at end of each working shift.

B. Final Clean Up
1. At the completion of work, remove all surplus materials, staging, rubbish; clean off all paint, varnish, stains from floors, glass, walls, hardware; and leave the premises in clean condition.

END OF SECTION 09 90 00

09 95 00 – WALL COVERING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for wall coverings. Additional requirements may be included within specific agreements or other contracting documents.

A. Use of Wallpaper/Wallcovering is not allowed in City facilities. Use of wallcovering must be approved by Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 09 95 00

09 97 00 – FLUID APPLIED FLOORING

5/25

PART 1 – GENERAL

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes administrative and procedural requirements for fluid applied flooring.
   1. Fluid-applied flooring, including:
      a. MMA acrylic.
      b. Urethane.
      c. Polyaspartic.
      d. Polycrete.
      e. Epoxy.
   2. Other specialized floor coatings.

B. Additional requirements may be included within specific agreements or other contracting documents.

C. Final acceptance of adequacy of proposed product and locations for use shall be determined by the Owner.

1.04 SUBMITTALS REQUIRED

A. Samples.

1.05 QUALITY ASSURANCE

A. Installer shall have a minimum of five (5) years' experience on installations of similar size and complexity.

B. Substrate moisture and alkalinity tests are mandatory for fluid applied flooring work on concrete to ensure moisture content does not exceed flooring manufacturer's requirements.

PART 2 – PRODUCTS

2.01 FLUID-APPLIED FLOORING

A. General
   1. Specify appropriate coating, performance topcoats and finish systems for intended use area.
   2. Preference for products produced in USA.
   3. MMA is the preferred system, other products can be specified with Owner approval.

B. Monolithic systems
   1. One-eighth (1/8) inch to one-quarter (¼) inch thick monolithic system to be:
      a. Slip-resistant.
      b. Fungus, mold, bacteria and stain resistant.
      c. Impact and puncture resistant.
      d. Waterproof.
      e. UV protected.
      f. Temperature tolerant.
      g. Decorative broadcast flake and/or natural quartz aggregate broadcast.
      h. Easy to clean.

C. Accessories

1. Sub-floor filler, adhesives, primers, sealers and underlayment shall be approved by product manufacturer and appropriate for substrate.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide all flooring, installation products and accessories from a single source for each product specified.
B. Use in restrooms, pool decks, locker/shower rooms, commercial kitchens and food service concessions areas with Owner approval.
C. Slab or existing floor must be smooth and dry before any installation.
D. Slope flooring to drain if new construction, cove up wall six (6) inch with neat, even and level top edge.

3.02 TESTING

A. Provide slab moisture tests prior to specifying resilient flooring to ensure that the proper adhesive is specified. Select adhesive according to results of moisture testing. Moisture test required immediately prior to installation of any product.

END OF SECTION 09 97 00

09 98 60 – FIBER REINFORCED PANELS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for fiber reinforced panels. Additional requirements may be included within specific agreements or other contracting documents.

1.03 RELATED SECTIONS

A. 10 26 00 – Wall and Door Protection.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 09 98 60

DIVISION 10: Specialties

10 05 00 – COMMON WORK RESULTS FOR SPECIALTIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for specialties. Additional requirements may be included within specific agreements or other contracting documents.

1.03 REQUIREMENTS

A. All specialties shall consider quality and visual standards. It is the intent of the Owner to standardize items across all City facilities.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 10 05 00

10 11 00 – VISUAL DISPLAY UNITS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for visual display units.
  1. Markerboards/whiteboards/marker wall panels.
  2. Tackboards/tack wall panels.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Samples.

1.04 QUALITY ASSURANCE
- A. Final acceptance of the adequacy of the proposed product shall be determined by the Owner.
- B. Glass whiteboards and chalk boards are not allowed to be specified.
- C. Provide in-wall wood blocking as required to secure boards to walls.
- D. Preference for products produced in USA.
- E. Qualifications
  1. Installer will have a minimum of five (5) years' experience in Colorado on installations of similar size and complexity.

PART 2 – PRODUCTS

2.01 MARKERBOARD/WHITEBOARD/MARKER WALL PANELS
- A. Boards to be LCS Porcelain enameled steel, face sheet metal shall be twenty-four (24) gauge minimum with smooth satin finish. Core: Wood fiber. Face shall be suitable for projection, magnetic, non-ghosting, no VOC's, non-combustible.
- B. Factory assembled units.
- C. Lifetime of the building warranty.
- D. Magnetic Accessories: Rare earth magnets and marker caddy for marker boards and marker wall panels.
- E. Five-eighth (5/8) inch aluminum perimeter trim with mitered, smooth corners, clear anodized finish
- F. Color: White.
- G. Attach with hangers and appropriate fasteners by manufacturer.
- H. Wall panels to be full height, mounting height and size of panel(s) to be determined depending on situation.
- I. Mount three (3) feet AFF to bottom edge of the marker/white board.
- J. Size and finish of the markerboard be determined depending on the situation and requirements.
- K. Wall panels to have no trim between panels.

2.02 TACKBOARDS/TACK WALL PANELS
- A. Tackboards: Five-eighth (5/8) inch aluminum perimeter trim with mitered, smooth corners, clear anodized finish.
- B. Oxidized linseed oil, rosin and finely ground cork board on one-quarter (¼) inch MDF backing.

C. Natural ground cork board material only with owner approval.
D. Color: To be determined.
E. Size of Tackboard: To be determined depending on location.
F. Attach with hangers and appropriate fasteners by manufacturer.
G. Mount three (3) feet to bottom edge of board for tack boards.
H. Tack wall panels to be full height or custom sized.
I. Colors can be selected from manufacturer's full range.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 10 11 00

10 14 00 – SIGNAGE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for signage.
   1. City logos.
   2. Building plaques.
   3. Building information.
   4. Space signs.
   5. Staff name plates.

B. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 CITY LOGOS

A. Locations: All buildings will have a minimum of one (1) large scale logo on the exterior of the building. All buildings will have a single logo in the lobby. Per department request, logos can be added in department lobbies. Location, number, and size to be determined by the Owner.

B. Materials: One-quarter (¼) inch brushed aluminum, typical. In some locations coating may be added for more contrast to the façade.

C. Signage to be stud mounted to surface.

D. Signs will not be illuminated.

2.02 BUILDING PLAQUES

A. Locations: In lobbies of all new buildings.

B. Materials: Twenty-four (24) inches wide by twenty-two (22) inches tall; one-quarter (¼) inch bushed stainless steel with etched lettering and black inlay.

C. Content: City logo; Building name; Council list and date for project approval; Council list and date for project opening; City Manager; Project Architect.

D. Plaque will be mounted at the four (4) corners with a pre-drilled hole.

2.03 BUILDING INFORMATION

A. Any Building Information: Hours, department listing, etc. that needs to be on the exterior will be a white vinyl.

2.04 SPACE SIGNS

A. Locations: All interior locations with the exception of private offices and workstations.

B. Materials: Curved-face modular sign with interchangeable segments and various panels and size configurations.
   1. Copy size to be 0.75 inches.
   2. Typeset SansSerif.
   3. Letter color to be white.
   4. Background Color: MP13863 Smoke.

C. Typical size to be six (6) inches high by nine (9) inches wide.

D. Preferred mounting is screwed into drywall or mounting brackets by sign manufacturer. Double sided tape will be allowed in specific instances. If a sign is mounted to a glass wall system, a vinyl backer will be provided to hide the tape.

2.05 STAFF NAME PLATES

A. Locations: All staff offices and workstations.
B. Materials: Curved aluminum frame with a transparent insert. Aluminum to be at top and bottom of sign.
   1. Offices: Six (6) inches high by nine (9) inches wide.
   2. Workstations: Two and one-quarter (2¼) inches high by nine (9) inches wide.
C. Mounting at offices will be double sided tape. If a sign is mounted to a glass wall system, a vinyl backer will be provided to hide the tape.
D. Mounting at workstations will require velcro or panel clips to go into a furniture panel.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 10 14 00

10 21 00 – COMPARTMENTS AND CUBICLES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for compartments and cubicles.
  1. Metal Toilet Compartments: Not acceptable. Allowed only with Owner written approval.
  2. Solid Phenolic Toilet Compartments: Preferred system (Owner will consider HDPE material).
  3. Shower and Dressing Compartments and Cubicles: Use solid phenolic compartments (Owner will consider HDPE material).
  4. Overhead metal curtain track and guides, ceiling mounted.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Permanent partition walls and masonry compartmentation are not permitted as substitutions for work.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.
- C. Samples.
- D. Maintenance Data.

1.04 DELIVERY, STORAGE, AND HANDLING
- A. Inspect doors, panels, hardware (all items) for shipping damage upon receipt.
- B. Break seal on site to permit ventilation.
- C. Maintain partitions clean, dry and protected against dampness. Store partitions away from possible damage by unloading of other materials. Blemishes and dents shall be cause for rejection. Keep away from heat and open flame. Prevent deformation during delivery, storage, and install.

PART 2 – PRODUCTS

2.01 MATERIALS SUMMARY
- A. Toilet/Shower/Dressing Compartments and Cubicles:
  1. Type: Floor mounted, overhead braced.
  2. Doors: Required at all toilet stalls.
- B. Solid Phenolic Toilet Compartments:
  1. One (1) inch thick high-pressure solid polymer resin.
  2. Pilasters: One (1) inch thick. Reinforced at the hinge side of accessible stall door, sufficient to prevent bending.
  3. Radiused machined edges.
  4. Burn strip at bottom.
  5. Class B rated.
  6. Prefer “shiplap” edge or attached hardware for sightline concealment.

2.02 ACCESSORIES

A. Head Rails and Trim: Hollow stainless-steel tube, with anti-grip profile and cast socket wall brackets. Overhead cross bracing required at accessible stalls.
   1. Head Rail: Sixteen (16) gauge stainless steel or anti-grip type tubular aluminum.
B. Attachments and Bolts: Continuous full-height attachment, stainless steel, or heavy-duty aluminum brackets. Stirrup brackets are not allowed. Concealed and vandal proof.
C. Pilasters: Six (6) inch minimum width continuous from floor to overhead brace.
D. Wall Brackets: Dividing partitions shall be attached to pilasters and wall with continuous stainless steel or aluminum tamper proof wall brackets.
E. Pilaster Shoes: Formed stainless steel. Provide adjustment for height variations with screw jack through steel saddles.
F. Reinforcement: Manufacturer's standard concealed type. Required for mounting toilet accessories. Provide for attached hardware and fittings.
G. Hardware:
   1. Hinges:
      a. Stainless steel or heavy aluminum extrusion.
      b. Surface mounted through-bolt type.
      c. Adjustable gravity type with concealed ball bearing rollers.
      d. Or approved equal.
   2. Latch and Keeper:
      a. Recessed with combination rubber faced door strike and keeper.
      b. Slide type latch operation.
      c. Rotary (twist) type prohibited.
      d. Pull: Required for swing-out doors only.
   3. Fasteners: Tamper-resistant, concealed stainless steel.
   4. Combination Coat Hook and Bumper:
      a. Manufacturer’s standard rubber-tipped stainless-steel unit.
      b. Mounted on door.
      c. Plastic material is prohibited.
      d. Provide one supplemental coat hook inside accessible stalls.
   5. Door Pull: Knob type not acceptable. Furnish pull for out swinging doors. Stainless steel.
   6. Heat sink on bottom of all panels and doors.
   7. Accessories to be surface mounted only. No holes are to be cut in partitions for accessories or otherwise.

2.03 FINISHING

A. Exposed Surfaces: Clear anodized finish.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify opening dimensions and plumbing fixture and rough-in locations are in compliance with ADA and ICC A117.1 required clearances.
B. Verify correct location of built-in framing, anchorage, bracing, and blocking.

3.02 INSTALLATION

A. Install partition components secure, plumb, and level.
B. Attached panel brackets securely using vandal-proof anchor devices
C. Adjust and align door hardware so free movement is attained and stand open position is maintained.

END OF SECTION 10 21 00

10 22 00 – OPERABLE PARTITIONS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for operable partitions.
  1. Operable partitions, manual operation.
  2. Accordion partitions and suspension system
  3. Ceiling track and operating hardware.
  4. Track support rods and accessories.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Motorized operable partitions require Owner authorization.
- D. Sliding and Coiling Partitions: Use discouraged.
- E. Folding Gates:
  1. Location approval by Owner.
  2. Keyed same as building master.
  3. Overhead type prohibited.
- F. Acoustical design of contiguous ceilings, floors, and permanent partitions must be consistent with acoustical properties of specified partitions.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.
- C. Test Reports.
- D. O&M Data.
- E. Samples.

1.04 QUALITY ASSURANCE
- A. Qualifications:
  1. Manufacturer:
     a. Company specializing in manufacturing and installing the products specified with a minimum of three (3) years' experience.
- B. Performance Requirements
  1. STC: Minimum of 50.
  2. NRC: No less than 0.55.
- C. Warranty
  1. The door shall be guaranteed for two (2) years. In addition, the pantographs, trolleys, and tracks are guaranteed for ten (10) years from date of acceptance for beneficial use.

PART 2 – PRODUCTS

2.01 COMPONENTS
- A. Construction:
  1. Operable Partition: Operable wall shall be a series of flat panels hinged in pairs omni-directional rolling type, not sliding, manually operated, top supported with operable floor

seals. Panel hinges shall be full leaf butt hinges, attached directly to panel frame. Welded hinge anchor plates within panel shall further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragals are not acceptable. Track shall be minimum eleven (11) gauge aluminum.

2. Accordion Partition: Frame shall consist of eighteen (18) gauge steel hinge plates arranged horizontally in an x-type pantograph configuration and welded to three-sixteenth (3/16) inch diameter vertical steel rods to create a three-dimensional frame. Intermediate rows of hinges shall be spaced approximately three (3) feet, six (6) inches apart as required. High tensile alloy trolley pins shall be encased in the structural hinge plate. End posts shall be minimum sixteen (16) gauge cold roll-formed steel.

B. Panels shall be nominal three (3) inches thick in manufacturer's standard width, four (4) feet maximum. All panel horizontal and vertical framing elements shall be formed steel. Frame shall be fully unitized with overlapped and welded corners to create a rigid structure independent of panel skin and facing materials. (Top channel shall be reinforced to support suspension system components.) Panel frame shall provide concealed steel edge protection of the skin material so as not to require exposed edge trim.

C. Panel skin shall be roll-formed steel wrapped around the panel edge and welded to the panel frame.

D. Sound Seals:
   1. Operable Partition: Vertical interlocking sound seal between panels (astragal) shall be required in each panel edge and must be of a tongue and groove configuration. Astragals shall be steel for maximum durability and fire resistance. Rigid plastic astragals or astragals in only one panel edge are not acceptable. Horizontal top seals shall be continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion and no mechanically operated parts. Horizontal bottom seals shall be automatic operable seals providing one (1) inch operating clearance with an operating range of 0.50-inch and shall automatically drop as panels are positioned without the need for tools or cranks.
   2. Accordion Partition: Sound insulation shall consist of grooved steel panels laminated to a heavy-duty, flame-resistant acoustical membrane. Sound insulation shall be independent of the outer covering and shall be mechanically fastened directly to the hinge plates
   3. Sound insulation to be included on all interior walls to prevent sound travel.

E. Hardware (Accordion Partition): Grip type hand pulls shall be die cast zinc, powder coated paint, and include a positive latch mechanism with thumb release. Partitions over eight (8) feet high shall include an upper pull-in latch with pendant pull handles. Extruded aluminum pulls or plastic hand pulls will not be accepted.

F. Perimeter Seals (Accordion Partition): Top and bottom seals shall each consist of two (2) sets of four (4) ply sweep strips. Lead post shall nest into jamb channel with sound seal on fixed wall or on the meeting post of a pair of partitions.

G. Suspension System: Manufacturers standard, unless otherwise noted.
   1. Accordion Partition: Track shall be continuous C-channel track enclosing trolley wheels. Exposed or unprotected tread surfaces will not be accepted. Partition shall be supported by two (2) wheel ball-bearing intermediate trolley assemblies and a four (4) wheel ball-bearing lead trolley assembly.

H. Air Release (Accordion Partition): A series of three-eighth (3/8) inch diameter holes through the lead post area shall permit trapped air to escape from within the partition during operation.

I. Accessories: Aluminum jambs. White enameled ceiling closures.

J. Finish shall be Class A rated, Flame Spread 15, Smoke Developed 15 and shall carry the UL Label. Standard or premium fabric, heavy duty vinyl, carpet, marker/tack board, plastic laminate or wood veneer are acceptable finish options.

PART 3 – EXECUTION

3.01 INSTALLATION

A. An authorized factory trained installer shall install partition. Supply additional structural support required by manufacturer for complete installation.
B. Install track supports and track level and true. Confirm track supports are laterally braced and will permit accordion partition to be level within one-quarter (¼) inch of required position and parallel to the floor surface.
C. Fit and align partition assembly level and plumb.
D. Adjusting:
    1. Adjust partition assembly to provide smooth operation from stacked to drawn position.
    2. Visually inspect partition in drawn position for light leaks to identify a potential acoustic leak. Adjust to achieve light seal.

END OF SECTION 10 22 00

10 26 00 – WALL AND DOOR PROTECTION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for wall and door protection.
  1. Corner guards.
  2. Impact resistant wall protection.
  3. Fiberglass reinforced panels (FRP).
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Samples.

1.04 QUALITY ASSURANCE
- A. Final acceptance of adequacy of proposed product shall be determined by Owner.
- B. Preference for products produced in USA.
- C. Qualifications
  1. Installer Qualifications: Installer will have a minimum of five (5) years' experience in the State of Colorado on installations of similar size and complexity.

PART 2 – PRODUCTS

2.01 CORNER GUARDS
- A. PVC free material with embossed texture, two (2) inch leg, three-eighth (3/8) inch wall offset, Class A rated, bullnose, aluminum retainer. Ninety (90) degree angle and other angles as required.
- B. End of wall and corner applications on all gypsum board corners and edges.
- C. Impact and chemical resistant.
- D. Replaceable cover and end caps.
- E. Forty-eight (48) inches high, mount at top of base, mechanically fastened. Full height with Owner approval.
- F. Color to blend with adjacent wall.
- G. Type 304 stainless steel corner guards with #4 finish to be specified in high impact traffic areas, rustproof, nonporous, beveled edges, radius corners. Install with construction adhesive or screws.

2.02 WALL PROTECTION
- A. Thirty-five (35) ounces per linear yard, flexible vinyl wall protection with polyester backing engineered to protect heavy abuse and high traffic areas.
- B. Clear protective coat.
- C. Fifty-two (52) inch wide rolls.
- D. Class A fire rated.
- E. Wall liner for walls other than gypsum board available.

2.03 FIBERGLASS REINFORCED PANELS (FRP)
- A. 0.09-inch-thick embossed, 0.075-inch-thick smooth, sheet wall and ceiling panels

B. Class A.
C. All moldings, trims, base, and accessories are required for complete installation.
D. Protective film finish.
E. All caulk, sealant and adhesive to be recommended by manufacturer.
F. Green Guard and USDA approved.
G. For use in food and beverage facilities, custodial areas. Not approved for use in restrooms by Owner.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 10 26 00

10 28 00 – TOILET, BATH, AND LAUNDRY ACCESSORIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for toilet, bath, and laundry accessories.
  1. Grab bars.
  2. Toilet tissue dispensers.
  3. Soap dispensers.
  4. Paper towel dispensers.
  5. Sanitary disposal.
  6. Mirrors.
  7. Mop holders.
  8. Baby changing table.
  9. Folding shower seat.
  10. Shower rod, curtains and hooks.
  11. Surface mounted coat hooks.
  12. Sanitary product vendors.
  13. Seat cover dispensers.
  14. Powered hand and hair dryers.
  15. Swimsuit spinner/dryer.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 RELATED SECTIONS
- A. 08 83 00 – Mirrors.

1.04 SUBMITTALS REQUIRED
- A. Product Data.
- B. Samples.

1.05 QUALITY ASSURANCE
- A. Warranty
  1. Submit a written warranty executed by mirror manufacturer agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
  2. Fifteen (15) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 GENERAL
- A. Recessed mounted is preferred for toilet tissue dispensers in the accessible stall.
- B. All other areas may be surface mounted.

2.02 MATERIALS
- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish.
- B. Mirror Glass: One-quarter (¼) inch (six (6) millimeter) float glass.
- C. Galvanized Steel Mounting Devices: ASTM A153, hot dipped galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of the same material as accessory unit or of galvanized steel where concealed. Exposed fasteners shall be theft resistant.

2.03 COMPONENTS

A. Buttons and knobs shall be operable with one hand and without tight grasping, pinching or twisting of the wrist. Operation of pull knobs shall not require more than five (5) pounds of force.
B. Furnish two (2) keys for each accessory to Owner. Master key accessories.

2.04 SCHEDULE

A. Grab Bars: Satin stainless steel. Peened grip.
   1. Provide one thirty-six (36) inch bar behind water closet and one forty-two (42) inch bar beside water closet at toilets.
   2. Prove vertical side bar.
   3. Provide bars in accessible toilet rooms and stalls, accessible showers and tubs, and ambulatory stalls.
B. Toilet Tissue Dispenser: OFCI.
C. Soap Dispenser: OFCI
D. Paper Towel Dispenser: OFCI. May use electric hand dryers in lieu of the paper towel dispensers with Owner approval.
E. Contractor to provide electrical box for automatic dispensers in restrooms. Typically, paper towel dispenser(s) and soap dispenser(s).
F. Sanitary Napkin Disposal: OFCI.
G. Mirror: Frameless, one-quarter (¼) inch thick float glass, thermosetting infrared-cured paint backing. All edges ground and polished smooth. Screw metal mounting clips to wall, engage mirror into clips.
   1. Eighteen inches (18) by thirty-six inches (36).
   2. Twenty-four (24) inches by sixty (60) inches
H. Mop Holders: Thirty-six (36) inch, four (4) anti-slip mop holders with rag rod below.
I. Baby Changing Table: OFCI.
J. Folding Shower compartment seat: Reversible with swing down legs, phenolic and stainless steel, satin finish.
K. Shower Rod/Curtain/Hooks: Heavy duty rod, satin finish. Opaque white vinyl curtain w/ hooks. Phenolic stall doors preferred instead of curtain and rod.
L. Surface Mounted Coat Hooks, and Hook Strips: Satin finish. Provide at shower and locker room areas, two single hooks in single restrooms.
M. Sanitary Product Vendors: Installed with Owner approval.
N. Seat Cover Dispensers: OFCI.
O. Powered Hand and Hair Dryers:
   1. Contractor to provide electrical box for automatic and powered dryers in restrooms and shower areas.
   2. Energy efficient, steel, adjustable with touchless activation.
   3. Ten (10) to twelve (12) second hand dry time, adjusted for hair drying.
   4. Universal Nozzle: Swivel or fixed for hair drying.
   5. Dryers for hair in shower areas, other areas with Owner approval.
P. Swimsuit Spinner/Dryer: Free standing or wall mounted, air cooled high cycle motor, safety brake, anti-vibration, quiet operation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install plumb and level, securely and rigidly anchored to substrate.
B. Use concealed tamperproof fastenings.
C. Provide hardboard backing at components occurring partially on tile and partially on gypsum board surface. Hold back one-quarter (¼) inch from edge of component and paint edge to match adjacent wall
D. Coordinate installation with the work of other trades, including sink, lavatory, partitions, urinal and toilet locations.
E. Defibrillator cabinets shall be coordinated with the Owner for placement and procurement.

END OF SECTION 10 28 00

10 44 00 – FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for fire extinguishers, cabinets, and accessories. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE
- A. Provide fire extinguishers, cabinets and accessories by a single manufacturer, per category.

1.04 REGULATORY REQUIREMENTS
- A. Environmental Requirements
  1. Observe environmental precautions based on conditions.
  2. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 – PRODUCTS

2.01 GENERAL
- A. Adhere to all accessible codes and standards.

2.02 FIRE EXTINGUISHERS
- A. ABC Multi-purpose Dry Chemical Fire Extinguishers
  1. For Class A, Class B, and Class C fires.
  2. Dry Chemical Type: Cast steel tank, with pressure gauge; ten (10) pounds.
  3. Extinguisher Finish: Steel, enamel to red color.
- B. Class K Wet Chemical Fire Extinguishers
  1. For Class K fires.

2.03 FIRE EXTINGUISHER CABINETS
- A. Metal: Formed aluminum; manufacturer’s standard.
- B. Configuration: Semi-recessed type, Rounded Edges.
- C. Cabinet Mounting Hardware: Appropriate to cabinet.
- D. Hinge doors for 180E opening with continuous piano hinge. Provide roller type catch.
- E. Weld, fill, and grind components smooth.
- F. Glaze doors with resilient channel gasket glazing and lettering.
- G. Finishing Cabinet Exterior Trim, Door, and Interior: Clear anodized.
- H. Signage. On the door.

2.04 ACCESSORIES
- A. Extinguisher Brackets: Formed steel, galvanized finish.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Install cabinets plumb and level in wall openings.
- B. Semi-recessed or surface mounted.

END OF SECTION 10 44 00

10 51 13 – LOCKERS AND LOCKER ROOM BENCHES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for lockers and locker room benches.
  1. Standard wardrobe lockers.
  2. Locker room benches.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Combination Listing.
- C. Shop Drawings.
- D. Samples.

1.04 QUALITY ASSURANCE
- A. Extra Stock:
  1. Provide paint code for each color of locker installed.

PART 2 – PRODUCTS

2.01 LOCKERS
- A. Standard:
  1. All new lockers to be solid phenolic core. All other materials to be approved by Owner.
  2. A minimum of five percent (5%) of lockers in each bank must be ADA and ICC A117.1 accessible.
  3. Standard Sizes:
     a. Variable based on location and use.
  4. Base: Concrete or alternative material as approved by Owner.
  5. Locking: Provide latch that is compatible with a user provided lock.
  6. Louvers should not be used, unless in areas containing showers.
  7. Phenolic lockers must meet ASTM E 84, Class B rating.
  8. Provide solid end panel.
- B. Equipment:
  1. Units over twenty-four (24) inches in height: Hat shelf, one single prong back hook, two (2) single prong side hooks, and one double prong ceiling hook.
  2. Units twenty-four (24) inches and less in height: One single prong back hook, two (2) single prong side hooks.
  3. Hinges: continuous, black with a one hundred-twenty (120) degree limited range.
- C. Accessories:
  1. Include number plates for each door, fastening devices, anchors, connectors, covers, trim, filler panels, finished end panels, and accessories as required for complete installation.
  2. Provide zinc plated, tamper resistant bolt and nut assemblies.

2.02 LOCKER ROOM BENCHES

A. Manufacturer’s standard units with materials to be approved by Owner seats approximately twelve (12) inches wide by 1.25-inch-thick.
B. Furnish steel pedestal supports not more than sixty-three (63) feet o.c., with provisions for fastening to floor and securing to benches. Furnish all the anchorages. Finish bench tops with manufacturer's standard clear coatings and pedestals with baked enamel.
C. Benches can be concrete.
D. Provide an accessible bench in each locker room, adjacent to accessible lockers if lockers are provided.
E. Consider addition of grab bar(s) adjacent to accessible benches.

2.03 MATERIALS

A. Phenolic:
   1. Solid phenolic core decorative plastic laminate with multiple resin-impregnated kraft and surface sheets fused at high temperature and pressure. Surface and edges to be non-porous. One-half (½) inch face, one-half (½) inch bottoms, three-eighth (3/8) inch sides.
B. Sheet Steel:
   1. Mild cold-rolled and leveled furniture steel, free from buckle, scale, and surface imperfections and capable of taking a high-grade enamel finish.
C. Expanded Metal:
   1. Only acceptable on backs of athletic lockers that mount back-to-back and venting is needed.
D. Fasteners:
   1. Zinc plated steel; exposed bolt heads, slot-less type; self-locking nuts or lock washers for nuts on moving parts, tamper-resistant.
E. Equipment:
   1. Hooks and hang rods of zinc plated steel or aluminum with ball points.

2.04 FABRICATION

A. Per manufacturer’s recommendations.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Conceal all fasteners wherever possible.
B. Install trim and sloping top units to provide a flush, hairline joint against adjacent surfaces. Install with concealed fasteners.
C. Where required, provide filler panels for closure to adjacent surfaces, factory-finished to match lockers. Provide a solid end panel on all exposed sides.
D. Touch-up marred finishes, or replace if not acceptable. Use only materials and finishes as recommended or furnished by the locker manufacturer.
E. Adjust doors and latches to operate easily without a bind.

3.02 CLEANING AND PROTECTION

A. Any damage to lockers shall be repaired and lockers shall be repainted to match factory applied finish. If damage cannot be repaired or finish cannot be properly matched, damaged lockers shall be replaced.
B. Lockers installed during construction that involve work by others in locker areas shall be cleaned thoroughly inside and out upon construction completion.

END OF SECTION 10 51 13

10 56 00 – STORAGE ASSEMBLIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for storage assemblies. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 OPEN TYPE SHELVING SYSTEM

A. Welded wire, friction assembled units. Provide shelf support clips for corners and equip uprights with adjustable leveling feet.

B. Furnish all shelf surfaces, supports and accessories in chrome plated finish.

C. Furnish seventy-two (72) inch high uprights, eighteen (18) inch deep, forty-eight (48) inch long units, six (6) shelves each tier. Include connectors and accessories required for a complete, stable installation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Verify field conditions to assure correct sizes, locations, details, adequacy and proper locations for backing, supports, bracing.

B. Provide in-wall blocking for all installations of shelving units to be secured to wall.

C. Include all anchors, accessories, trim and similar items required for complete, functional installation. Install per manufacturer's recommendations.

END OF SECTION 10 56 00

10 57 00 – WARDROBE AND CLOSET SPECIALTIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for wardrobe and closet specialties.
  1. Coat racks.
  2. Coat hooks.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.
- C. Samples.

1.04 QUALITY ASSURANCE
- A. Qualifications
  1. Manufactured items shall be produced by firms normally engaged in the manufacture of the specified items under a monitored quality control program.

PART 2 – PRODUCTS

2.01 COAT RACKS
- A. Wall mounted, single shelf wall rack system, tubular steel rack with mounting brackets with standard or closed loop hangers.

2.02 COAT HOOKS
- A. Metal coat hooks mounted on wood or stainless steel rail.
- B. Nylon unbreakable coat hooks mounted on wood rail. Each hook to hold up to eighty-eight (88) pounds when installed per manufacturer's instructions.
- C. Wall mounted costumer with four (4) knobs and two (2) coat hangers, laminate finish, one per private office.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Install all specialty items using concealed fasteners, in-wall blocking and anchorage appropriate for the substrate.

END OF SECTION 10 57 00

10 75 00 – ALUMINUM FLAGPOLES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for aluminum flagpoles.
  1. Ground set aluminum flagpoles.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Structural Calculations.
- C. Finish Samples for Verification.

1.04 QUALITY ASSURANCE
- A. Performance Requirements
  1. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to the building code in effect for the Project or NAAMM FP 1001, “Guide Specifications for Design Loads of Metal Flagpoles,” whichever is more stringent.
     a. Base flagpole design on maximum standard-size flag suitable for use with pole or flag size, whichever is more stringent.
     b. Basic Wind Speed: One hundred-ten (110) miles per hour.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Remove all packaging materials, unwrap pole(s) and store off ground.

PART 2 – PRODUCTS

2.01 GENERAL
- A. Obtain each flagpole as a complete unit from a single manufacturer, including fittings, accessories, bases, and anchorage devices.

2.02 FLAGPOLES
- A. Pole Construction, General: Construct poles and ship to project site in one piece.
- B. Aluminum Flagpoles: Fabricate from seamless, extruded tubing.
  1. Provide entasis-tapered aluminum flagpoles.
  2. Fourteen (14) gauge flush seam spun aluminum gold anodized finial ball at top of pole, set on cast aluminum revolving hood and truck.
- C. Foundation Tube: Galvanized corrugated-steel foundation tube.
- D. One (1) United States Flag, one (1) Colorado State Flag. US flag to be hung higher than Colorado flag. If more than one flagpole, the flagpole flying the US flag shall be higher than surrounding flagpoles.
- E. Spare parts and tools:
  1. Two (2) cranks.
  2. One (1) truck.
  3. One (1) winch.
  4. One (1) weight assembly.

5. One (1) external halyard cleat.
6. One (1) external halyard truck.

2.03 FITTINGS

A. Cap Manufacturer's standard flush-seam ball to match pole-butt diameter.
B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
C. Halyard Flag Snaps: Provide two (2) swivel snap hooks per halyard, as follows:
   1. Galvanized Steel.

2.04 MISCELLANEOUS MATERIALS

A. Concrete: Pole shall be set into ground a minimum of three feet, install per manufacturer's instructions.
B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout.
C. Sand: Fine aggregate.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
B. Aluminum: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
   1. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

2.06 DIMENSIONS

A. Minimum Dimensions:
   1. Exposed Height: Thirty-five (35) feet.
   2. Overall Height: Thirty-eight (38) feet, six (6) inches.
   3. Butt Diameter: Six (6) inches.
   4. Top Diameter: Three and one-half (3½) inches.
   5. Tapered Length: Approximately twenty (20) feet.
   6. Straight Length: Approximately eighteen (18) feet, six (6) inches.
   7. Ship Sections: One (1).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install per flagpole manufacturers' installation instructions.

END OF SECTION 10 75 00

DIVISION 11: Equipment

11 31 00 – RESIDENTIAL APPLIANCES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for residential appliances.
  1. Refrigerator/Freezer.
  2. Dishwasher.
  3. Range/Oven.
  4. Range hood.
  5. Microwave ovens.
  6. Washer.
  7. Dryer.
  8. Ice maker.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Samples.

1.04 QUALITY ASSURANCE
- A. Warranty
  1. Manufacturer's standard form for each appliance specified, agrees to repair or replace residential appliances or components that fail in material or workmanship within specified warranty period.
- B. All appliances to be stainless steel finish. Other finishes to be approved by Owner.
- C. Final acceptance of the adequacy of the proposed product shall be determined by the Owner.

1.05 REGULATORY REQUIREMENTS
- A. All appliances to be Energy Star rated.

PART 2 – PRODUCTS

2.01 REFRIGERATOR/FREEZER
- A. Nominal thirty (30) inches wide, standard. Other widths with Owner approval.
- B. Factory installed icemaker and storage bin.
- C. Automatic defrost.
- D. Total Cubic Foot Capacity: Depending on use.
- E. Bottom freezer or top freezer if fifty percent (50%) of the freezer space is below fifty-four (54) inches. No side-by-side refrigerator/freezers to be specified.
- F. In-door ice maker and water distribution system to be approved by Owner.
- G. All controls must allow parallel approach with maximum high side reach of forty-eight (48) inches.
- H. Undercounter refrigerator must fit under accessible countertop.

2.02 DISHWASHER

A. Built-in only, counter-top or portable dishwashers are prohibited.
B. Standard Size: Thirty-two and one-quarter (32¼) inch height by twenty-three and three-quarters (23¾) inch width by twenty-three and one-half (23½) inch depth. Eighteen (18) inch width can be specified depending on intended use capacity.
C. Stainless steel tub and door liner.
D. Electronic front controls, four (4) cycles, four (4) options, delay start.

2.03 RANGE/OVEN
A. Freestanding electric range, front controls with storage drawer.
B. Nominal thirty (30) inches wide, top of range to sit flush with top of countertop.
C. Cooktop Surface: Smooth top, four (4) burners.
D. Self-cleaning.
E. Five (5) cubic foot oven capacity.

2.04 RANGE HOOD
A. Ducted.
B. Minimum two (2) speed fan.
C. Carbon Filter.
D. LED light.
E. Recirculating units are prohibited.

2.05 MICROWAVE OVENS
A. Countertop only, no microwaves to be installed over range.
B. Size capacity depends on use.

2.06 WASHER
A. Front load
B. Stainless steel wash basket.
C. Controls with delay wash capability.
D. 4.5 cubic foot capacity.

2.07 DRYER
A. Front load.
B. Coated steel drum.
C. 7.5 cubic foot capacity.

2.08 ICE MAKER
A. See 11 40 00 – Food Service Equipment.

PART 3 – EXECUTION

3.01 PREPARATION
A. Verify proper surface backing for anchoring equipment. Examine electrical connections to actual location and outlet configuration before appliance installation.

3.02 INSTALLATION
A. Coordinate all utilities, including electrical, water supply, drainage and exhaust.
B. Comply with manufacturer's instructions for installation.
C. Verify that clearances are adequate to properly operate equipment.

END OF SECTION 11 31 00

11 40 00 – FOOD SERVICE EQUIPMENT

04/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for food service equipment. Additional requirements may be included within specific agreements or other contracting documents.

B. Items in a commercial kitchen may include:

1. Food storage equipment.
2. Food preparation equipment.
3. Food delivery carts.
4. Food cooking equipment.
5. Hood and ventilating equipment, including fire suppression.
6. Food dispensing and serving equipment.
7. Ice machines.
8. Cleaning and disposal equipment.

C. Work in this section is limited to commercial products and material specified and installed by a commercial kitchen consultant, contractor and installer, pre-approved by the Owner. Food Service Consultant shall work with Owner to determine appropriate equipment.

1.03 SUBMITTALS REQUIRED

A. Product Data: For each piece of equipment.

B. Cut Sheet Specifications: For each piece of equipment.

C. Shop Drawings.

1.04 QUALITY ASSURANCE

A. All equipment is to be approved by the City of Fort Collins Building Repair and Maintenance Department.

B. Final acceptance of adequacy of proposed product shall be determined by Owner.

C. Products, installation and materials must meet criteria of all agencies having jurisdiction, local health department and manufacturer's recommendations and standards.

1.05 RELATED SECTIONS

A. 11 31 00 – Residential Appliances.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify proper surface backing for anchoring equipment. Examine electrical connections to actual location and outlet configuration before appliance installation.

3.02 INSTALLATION

A. Comply with manufacturer's instructions for installation.

B. Coordinate all utilities, including electrical, water supply, drainage and exhaust.

END OF SECTION 11 40 00

11 50 00 – EDUCATIONAL EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for educational equipment.
  1. Electric and gas fired kilns.
  2. Accessories.
  3. Specialty furnishings and equipment.
  4. Exhaust.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.

1.04 QUALITY ASSURANCE
- A. Coordination of electrical, mechanical and code issues is required.

PART 2 – PRODUCTS

2.01 GAS FIRED KILNS
- A. Gas fired kilns to be in secured, outdoor enclosures, interior locations for gas kilns are prohibited.

2.02 ELECTRIC KILNS
- A. Top loading, stainless steel clad, fire brick kiln with stand. Standard heating elements. Twenty-three thousand (23000) watts, industrial grade wiring, Cone 1-10 model, depending on use and power available.

2.03 ACCESSORIES
- A. All kilns, accessories and specialty furnishings to be approved by Owner.
- B. Accessories and furnishings can include:
  1. Shelving.
  2. Wheels.
  3. Slab rollers.
  4. Tables.
  5. Pugmills.
  6. Drying cabinets.
  7. Wedging tables.

PART 3 – INSTALLATION (NOT USED)

END OF SECTION 11 50 00

11 66 00 – ATHLETIC EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for indoor athletic and recreation equipment.
  1. Basketball backstops – main and practice court.
  2. Weight room/exercise equipment.
  3. Gymnasium dividers.
  4. Floor inserts.
  5. Scoreboards.
  6. Protective padding.
  7. Mirrors.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Samples.

1.04 QUALITY ASSURANCE
- A. Final acceptance of adequacy of proposed product shall be determined by Owner.
- B. Preference for products produced in USA.
- C. Qualifications
  1. Installer will have a minimum of five (5) years' experience in Colorado on installations of similar size and complexity.
- D. Climbing walls, ladders, ropes, tether ball posts, and other indoor gymnasium equipment to be approved by Owner.

1.05 RELATED SECTIONS
- A. 06 64 00 – Wood Flooring.
- B. 08 80 00 – Glazing.
- C. 09 65 00 – Resilient Flooring.
- D. 12 66 00 – Telescoping Bleachers.

PART 2 – PRODUCTS

2.01 BASKETBALL BACKSTOPS
- A. Supplier shall provide all required steel support structure and anchoring devices necessary to securely attach each backstop to steel roof members.
- B. Clear acrylic backboard with perimeter padding.
- C. Folding, adjustable height or fixed, main and side courts with safety retention system required for all retractable backboards.
- D. Provide remote electric winches incorporating emergency provisions for manual operation in case of power failure. Winch design shall incorporate integral up and down limit switches. Safety disconnects to be provided by the backstop manufacturer.

E. All keyed switches to be protected with a heavy-duty protective grille.
F. Mount ten (10) feet to hoop on fixed units.

2.02 WEIGHT ROOM/EXERCISE EQUIPMENT

A. Coordinate and review with Owner for all weight room and equipment.

2.03 GYMNASIUM DIVIDERS

A. Overhead coiling with powered keyed operation with controlled upper and lower limits of travel, safety disconnect.
B. Provide recessed three position key switch and cover plate.
C. Flame retardant, anti-bacterial treated, fungal resistant.
D. Solid vinyl panels at lower eight (8) feet with open fabric mesh above.
E. Provide all required and necessary support system for divider to be secured to roof structure.

2.04 FLOOR INSERTS

A. Volleyball – grout type floor sleeve with attached hinged cover.
B. Coordinate diameter of sleeve with volleyball standards to be used.
C. Cover shall conceal anchor screws and hinge shall be flush with top of Gymnasium floor surface.
D. One (1) main volleyball court and two (2) short/side courts.
E. Roof structure mounted volleyball system to be approved by Owner.

2.05 SCOREBOARDS

A. Gymnasium scoreboard
    1. Wall mounted, ten (10) foot by six (6) foot single-sided LED, two (2) inch, ten (10) inch and thirteen (13) inch digit sizes.
    2. Displays period time to ninety-nine minutes, fifty-nine seconds (99:59), Home and Guest scores to one hundred-ninety-nine (199), Period to nine (9), Player number to ninety-nine (99), player Foul to nine (9), team Fouls to nineteen (19), TOL (time outs left) to nine (9) and indicated possession and bonus. When the period is less than one (1) minute, the display time is to one-tenth (1/10) of a second. Electronic captions automatically change when volleyball is selected.
    3. Scoreboard to score basketball and volleyball.
    4. Battery back-up, wireless tabletop control.
    5. High-strength polycarbonate digit covers to protect from ball impact.
    6. All digits and electronic components to be accessed through the front face.
    7. Mounting accessories, ring, bolts by manufacturer, mount per manufacturer's procedures and details.
B. Swimming (aquatics) pool scoreboard:
    1. LED electronic scoreboard specifically designed for pool environment.
    2. Numeric scoreboard can be set to display information for swimming, diving, water polo and synchronized swimming, ten (10) feet high digits, red or amber.
    3. Wall mounted, size to be determined.

2.06 PROTECTIVE PADDING

A. Removable wall padding, two (2) inch thickness, foam mounted to seven-sixteenth (7/16) inch wood board, z-clip attached, install four (4) inches above floor.
B. Two (2) feet by six (6) feet tall, nineteen (19) ounces, Class A fire rated.
C. Install on walls at basketball key/lane, three (3) point line, side courts, protruding portions of wall, columns, ends of walls, items mounted on wall, etc. per manufacturer's industry standard.
D. Cutout with insert for utility outlets.
E. Custom graphics with Owner approval.

2.07 MIRRORS

A. Reference 08 83 00 – Mirrors.

B. Provide full height in weight, fitness and dance spaces. Mount from six (6) inches to six (6) feet AFF.
C. Ballet Barre at Mirror
    1. Mount double or single barre on mirror with brackets between joint of mirror glass with no interruption in mirror, when mirror is scheduled to be installed.

PART 3 – EXECUTIONS

3.01 PREPARATION
A. Verify surface backing and structural support integrity for installation of all equipment.
B. Coordinate electrical power for dividers, retractable backstops, mat hoists and scoreboards.

END OF SECTION 11 66 00

DIVISION 12: Furnishings

12 05 00 – COMMON WORK RESULTS FOR FURNISHINGS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for furnishings. Additional requirements may be included within specific agreements or other contracting documents.

B. All furniture specs to be approved by the Owner prior to ordering.

C. Furniture must be entirely freestanding and not attach to any vertical surface.

D. Furniture must be part of a flexible system that can be adapted for future changes.

E. Furniture should be height adjustable when appropriate in areas such as workstations.

1.03 REGULATORY REQUIREMENTS

A. Observe environmental precautions based on conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 12 05 00

12 20 00 – WINDOW TREATMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for window treatments.
  1. Roller shades.
  2. Motor operated roller shades.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.
- C. Samples.
- D. Schedule.
- E. Maintenance Data.
- F. Engineering.

1.04 QUALITY ASSURANCE
- A. Qualifications
  1. Installers shall be approved by the manufacturers and shall be experienced in installing and adjusting shades to provide smooth trouble-free operation.
- B. Warranty
  1. Provide twenty-five (25) year or lifetime warranty from manufacturer of system.

PART 2 – PRODUCTS

2.01 HORIZONTAL LOUVER BLINDS
- A. Use of horizontal louver blinds is prohibited.

2.02 ROLLER SHADES
- A. Roller Shades:
  1. All parts shall be made by one manufacturer.
  2. Single or double shade bracket options.
  3. Multi-banding and large shade applications.
  4. Overrunning-clutch drive system.
  5. Self-lubricating large diameter sprocket.
  6. Window jamb mounted, wall mounted or recessed in ceiling pocket.
- B. Roller Tubes:
  1. Extruded aluminum, size as recommended by manufacturer, selected for suitability for installation conditions, span and weight of shades.
  2. Fabric Attachment: Extruded channel in tube to accept vinyl spine welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spine from the side of the roller tube. Mounting of shade shall not require use of adhesives, tapes, staples or rivets.

3. Roller tubes to be able to be removed and reinstalled without affecting roller shade limit adjustments.

C. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated to accommodate shade fabric roll-up size and weight.
   1. One-eighth (1/8) inch (three (3) millimeter) thick steel.

D. Hembars:
   1. Full fabric wrapped bottom bar, flat profile with heat sealed closed ends.
   2. Room darkening shades to have a slot in the bottom bar with wool-pile light seal.

E. Clutch Operators:
   1. Heavy duty one-eighth (1/8) inch steel mounting bracket and integrated steel brake, clutch and sprocket assembly, rigidly affixed to shade support and user control.
   2. Permanently lubricated maintenance-free brake assembly.
   3. Brake to withstand minimum pull force of fifty (50) pounds in stopped position.
   4. Maximum shade hanging weight of eighteen (18) pounds.
   5. Drive Chain: Continuous loop stainless steel beaded ball chain, one hundred (100) pounds. Maximum breaking strength, provide upper and lower limit stops.
   6. Accessories: No removable fascia, unless approved by Owner.
   7. Ceiling Pockets: Premanufactured metal shade pocket for recessed mounting in acoustical tile or drywall ceilings, removable, ceiling support.
   8. Solar Shade Fabric: PVC and Polyester Woven in two (2) by two (2) basket weave pattern, providing a uniform scrim effect with an appropriate density for sun control. Provide three percent (3%) to five percent (5%) openness, non-flammable colorfast fabric, meet requirements for a Class 1 Finish, bacterial and fungal and fade resistant. Selection from full range of available colors.
   9. Black Out Shade Fabric: One hundred percent (100%) Lightweight glass yarn, acrylic coated white backing, meet requirements for Class 1 Finish. Selection from full range of available colors.
   10. Room Darkening Channels: Extruded aluminum side and center channels with brush pile edge seals and concealed fasteners. Channels to accept one-piece exposed blackout hem bar to assure side and sill light control.

F. Motorized Shade Hardware and Shade Brackets:
   1. Stamped steel, styrene-based plastics, and/or polyester, reinforced polyester shall not be accepted.
   2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).

2.03 SHADE MOTOR SYSTEMS

A. Shade Motors:
   1. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
   2. Conceal motors inside shade roller tube.
   3. Maximum current draw for each shade motor of 2.3 amps.
   4. Use motors rated at the same nominal speed for all shades in the same room.
   5. Total hanging weight of shade band shall not exceed eighty percent (80%) of the rated lifting capacity of the shade motor and tube assembly.
   6. One motor shall operate three (3) shades in this example. Can be otherwise as needed.

B. Motor Control Systems:
   1. IQ/MLC: Specifications and design of shade motors and motor control system are based on the IQ/MLC motor logic control system (as long as three (3) shades per motor can be met). Other systems may be acceptable provide that all of the following performance capabilities are provided. Motor logic control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
      a. Motor Control System:
         i. Provide power to each shade motor via individual three (3) conductor line voltage circuits connecting each motor to the relay based motor logic controllers (IQ/MLC).
         ii. Control system components shall provide appropriate (spike and brown out) over-current protection (± ten (10%) of line voltage) for each of the four (4) individual motor circuits and shall be rated by UL or ETL as a recognized component of this system and tested as an integrated system.
         iii. Motor control system shall allow each group of four shade motors in any combination to be controlled by each of four local switch ports, with up to fourteen possible "sub-group" combinations via local three (3) button wall switches and all at once via a master three (3) button switch. System shall allow for overlapping switch combinations from two or more local switches.
         iv. Multiple "sub-groups" from different IQ/MLC control components shall be capable of being combined to form "groups" operated by a single three (3) button wall switch, from either the master port or in series from a local switch port.
         v. Each shade motor shall be accessible (for control purposes) from up to four local switches and one master switch.
         vi. Control system shall allow for automatic alignment of shade hem bars in stopped position at twenty-five percent (25%), fifty percent (50%), and seventy-five percent (75%) of opening heights, and up to three (3) user-defined intermediate stopping positions in addition to all up/all down, regardless of shade height, for a total of five (5) positions. Control system shall allow shades to be stopped at any point in the opening height noting that shades may not be in alignment at these non-defined positions.
         vii. Control system shall have two standard operating modes: Normal mode allowing the shades to be stopped anywhere in the window’s opening height and uniform mode, allowing the shades to only be stopped at the predefined intermediate stop positions. Both modes shall allow for all up/all down positioning.
         viii. Control system components shall allow for interface with both audiovisual system components and building fire and life safety system via a dry contact terminal block.
         ix. Control system components shall allow for interface with external analog input control devices such as solar activated controllers, twenty-four (24) hour timers, and similar items; via a dry contact terminal block.
         x. Reconfiguration of switch groups shall not require rewiring of the hardwired line voltage motor power supply wiring, or the low voltage control wiring. Reconfiguration of switch groups shall be accomplished within the motor control device (IQ/MLC).
      b. Wall Switches:
         i. Connect local wall switches to control system components via low voltage (12V DC) four (4) conductor modular cable equipped with RJ-11 type connectors.

ii. Connect master wall switches to control system components via low voltage (12V DC) six (6) conductor modular cable equipped with RJ-12 type connectors.

2. Accessories:
   a. Roller shade pocket for wall mounting above the one hundred-twenty (120) inches by forty-eight (48) inches (approximately) windows.
   b. Fascia
      i. Fascia shall be able to be installed across three (3) shade bands in one piece.
      ii. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
      iii. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
      iv. Provide bracket/fascia end caps where mounting conditions expose outside of roller shade brackets.

2.04 FABRICATION

A. Fabricate blinds to fit within openings with uniform edge clearance of three-eighth (3/8) inch.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install shade level, plumb and located so exterior louver edges in any position are not closer than one (1) inch to interior face of glass lites.
   1. Mount inside of window frame, not on face of frame or as indicated on drawings.
B. Secure in place with concealed fasteners.
C. Window treatments should be fastened beyond trim, reaching the window frame, blocking, or wall stud.

END OF SECTION 12 20 00

12 30 00 – CASEWORK

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for casework. Additional requirements may be included within specific agreements or other contracting documents.

1.03 RELATED SECTIONS
- A. 06 20 00 – Finish Carpentry.

PART 2 – PRODUCTS

2.01 GENERAL
- A. Factory made, site-assembled constructed casework.

2.02 PLASTIC LAMINATE
- A. Refer to Division 06 20 00 – Finished Carpentry for Plastic Laminate.

2.03 HARDWARE
- A. Refer to Division 06 20 00 – Finished Carpentry for Hardware.

PART 3 – EXECUTION

3.01 PREPARATION
- A. Verify in-wall blocking and supports for proper location and support of casework.
- B. Field verify all dimensions and conditions before fabrication and installation.

3.02 INSTALLATION
- A. Seal top and bottom edges of all backsplashes with appropriate caulking to preclude moisture penetration.

END OF SECTION 12 30 00

12 50 00 – FURNITURE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMETS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for furniture. Additional requirements may be included within specific agreements or other contracting documents.
B. Furniture will match building or department standard if one exists.
C. Furniture shall be part of lines and manufactures where parts will be available for at least the next fifteen (15) years.
D. Furniture will have a flexible configuration in order to be adaptable in the future.
E. Overhead bins may not attach to a fixed wall surface. They must attach to the base of the desk.
F. If practical based on usage, sit-stand options should be incorporated.
G. All questions regarding furniture shall be directed to the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 12 50 00

DIVISION 13: Special Construction

13 11 00 – SWIMMING POOLS AND EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for swimming pools and equipment.
   1. Swimming Pools: Indoors/outdoors, including accessories.
   2. Pool deck construction.
   3. Pool piping, fittings, pumps and equipment.

1.03 RELATED SECTIONS

A. 11 66 00 – Athletic Equipment.
B. 06 97 00 – Fluid Applied Flooring.

1.04 PROCEDURES AND REQUIREMENTS

A. Submit shop drawings, product data, color options and samples
B. Final acceptance of adequacy of proposed products and systems shall be determined by Owner.
C. Architect/Engineer shall employ a swimming pool consultant who shall work with the Owner to determine size and capacity, appropriate materials, equipment, accessories and operational requirements.
D. Installer will have a minimum of five (5) years' experience in Colorado on installations of similar size and complexity and have successfully completed a minimum of six (6) pools of this type. Pool contractor shall furnish complete evidence that they have facilities, equipment, personnel and schedule abilities to complete all phases of the project.
E. All materials and equipment to be approved by Owner.
F. Manufacturers recommendations for installation and use of all products should be followed.
G. Renovated pools to follow this standard, ordinary maintenance not included.
H. Pool types (indoor and outdoor) include pools intended for accredited competitive aquatic events, public and recreational use, wading pools, warm water/therapy pools.
I. All pools and equipment to be designed to be of a higher standard than the minimum of the most stringent codes.

PART 2 – PRODUCTS

2.01 SWIMMING POOLS AND ACCESSORIES

A. Interior pool lighting is not preferred by Owner. Run lighting around sides, with indirect lighting over pool.
B. Overflow design shall not have water draining into strainer pot – spill over gutter system/overflow design.
C. Provide warranty for pool shell and surfacing materials
D. Provide on-deck showers
E. Modular vinyl/steel hybrid pool system can be considered.

F. Outdoor Pool: Plan for ease of winterization and season start-up – low point drainage, specific airlines to blow-out and isolated sections of pool.
G. Provide safety signage in accordance with authority having local jurisdiction, including sign marking location of pump emergency shut-off switch.
H. Cover for outdoor pools.

2.02 POOL DECK CONSTRUCTION

A. Concrete horizontal deck surface, broomed finish for interior and exterior pools. Selected material should be appropriate for climate. Other finishes only with approval from Owner.
B. Consider accessibility to above pool fans, devices and lighting for maintenance.

2.03 POOL PIPING, FITTING, PUMPS, AND EQUIPMENT

A. Railings and hangers to be aluminum. Pump room components (fasteners, brackets, etc.) to be stainless steel, fiber or painted galvanized.
B. Pump Room: Provide redundancy for maintenance if one pump is out of operational service. Ensure adequate access space around pumps for movement, overhead I-beam trolley hoist or crane to move pump outside and access from interior and exterior is required.
C. Drainage: Design drains to meet all entrapment protocol. Prefer main drain direct to sewer. Low point drainage or ability to isolate sections of the pool for blow-out desired in design (for winterization and start-up).
D. Heaters: No gas fire heaters to be utilized. Provide heat exchangers and water to water exchanger. Heater systems to be approved by Owner.
E. Storage Room: Mechanical equipment and Corrosive chemical storage rooms are required. Provide signage at all storage rooms, stating what is stored, including corrosive materials. Corrosive storage room shall have spill containment curb around inside of space and ramps inwards and outward to enable wheeled transport of drums. Storage rooms should have negative air pressure and exterior access with signage. Rooms to be climate controlled, ten (10) foot by ten (10) foot minimum size. Stored materials include bleach and acid. Include flow meter, chemical resistant doors, keyed separately. Dedicated drive-up access is required for chemical/freight delivery – loading dock preferred, placed away from common spaces or public entrances. Plumbing from the pump room to go into corrosive storage room (chemicals are injected into the system). Flow meter to be tied into chemical controller.
F. Filters: Regenerative only, no sand filters. Must have appropriate space around filters for adequate flow, consistent with code.
G. UV Systems: Medium pressure
H. Pool Automation System: Easily accessible, web access
I. Pneumatics with compression system for wave pool
J. Pumps: Gravity fed, PFD to control all pumps over ten (10) horsepower, all pumps over ten (10) horsepower to have a variable frequency drive for control.
K. No gas fired heaters. Consider solar power for heaters.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 13 11 00

13 34 19 – METAL BUILDING SYSTEMS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for metal building systems. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Primary Framing Steel:
   1. Steel for hot rolled shapes must conform to the requirements of ASTM A36, A572 or A992.
   2. Steel for built-up sections must conform to the requirements of ASTM A1011, A1018, A529, A572 or A36 as applicable.
   3. Round Tube must conform to the requirements of ASTM A-500 Grade B.
   4. Square and Rectangular Tube must conform to the requirements of ASTM A500 Grade B.
   5. Steel for Cold-Formed sections must conform to the requirements of ASTM A1011 or A1039 Grade 55, or ASTM A653 Grade 55.
   6. X-Bracing will conform to ASTM A529 for rod bracing, ASTM A992 for angle bracing or ASTM A475 for cable bracing.

B. Secondary Framing Steel:
   1. Steel used to form purlins, girts and eave struts must meet the requirements of ASTM A1011 or ASTM A1039 Grade 55 for primed material or ASTM A653 Grade 55 for galvanized material with a minimum yield of fifty-five (55) ksi.
   2. Design Thickness: Gauge to be determined by design to meet specified loading conditions.

C. Panels:
   1. Roll-formed Galvalume, pre-painted Galvalume or Galvanized G90 Exterior-Side and G60 Interior-Side.
   2. Standing Seam Panels must have:
      a. Fifty percent (50%) minimum aluminum-zinc alloy- coating and conform to ASTM A792 or ASTM A653 with a minimum yield of fifty (50) ksi.
   3. Through-fastened panels must have:
      a. Fifty percent (50%) minimum aluminum-zinc alloy coating and conform to ASTM A792 or ASTM A653 with a minimum yield of fifty (50) ksi.
   4. Panel Finish:
      a. SP Finish: Modified Siliconized Polyester paint system with a twenty-five (25) year finish warranty.
      b. PVDF Finish: Seventy percent (70%) PVDF paint system with a thirty-five (35) year finish warranty.
   5. Panel Fasteners:
      a. For Galvalume and painted finished roof panels: Long life cast zinc head.
      b. For Wall Panels: Coated carbon steel.

c. Color of exposed fastener heads to match the wall and roof panel finish.
d. Concealed Fasteners: Self-drilling type, of size required.
e. Flashing and Trim: Match material, finish, and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weathertightness and a finished appearance.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install per manufacturer specifications.
B. Clean steel before erecting.

END OF SECTION 13 34 19

DIVISION 14: Conveying Equipment

14 20 00 – ELEVATORS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for elevators. Additional requirements may be included within specific agreements or other contracting documents.
- B. Pre-engineered traction passenger elevator system not requiring a machine room with a closet adjacent to the elevator shaft, pit ladder, controllers, equipment, and fittings.
- C. All elevators shall have a battery backup system that returns the elevator to the lowest floor and opens the doors in the event of a power outage.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Product Data.
- C. Samples.
- D. List of Successful In-Service Projects.
- E. Closeout Submittals.

1.04 QUALITY ASSURANCE
- A. Warranty
  1. Special Project Warranty: Provide special project warranty, signed by Contractor, Installer and manufacturer agreeing to replace, repair or restore defective materials and workmanship of elevator work during warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
  2. Warranty period is two (2) years starting on the date of Substantial Completion. Service shall be performed once every ninety (90) days minimum.
- B. Maintenance Service
  1. Furnish service and maintenance of elevator for one (1) year from Date of Substantial Completion. State services, obligations, conditions and terms for agreement period and for future renewal options.

1.05 REGULATORY REQUIREMENTS
- A. Electric Traction Passenger Elevators
  1. Controls System:
     a. Single automatic operation elevator control system, two-way self-leveling.
  2. Interconnect elevator control system with building fire alarm.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. TKE.
- B. Or approved equal.

2.02 METAL

A. Recycled Content: Minimum five percent (5%) post-consumer recycled content, or minimum twenty percent (20%) pre-consumer recycled content at contractor's option.
   1. Acute Ecotoxicity: Ts1 for soil and Tw1 for water in accordance with ASTM D6046.

2.03 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Disconnect switch to be located next to control panel.
B. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for purpose specified and indicated.
C. Phone In Car: Auto dial to the City Number to be determined per job, when handset is picked up.

2.04 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE – ELECTRIC TRACTION PASSENGER ELEVATORS ONLY

A. Controller: Provide microcomputer-based control system to perform all of the functions
   1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
   2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
   3. Provide a serial card rack and main CPU board containing a non-erasable EPROM and operating system firmware.
   4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.
B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.

2.05 FABRICATION

A. Car:
   1. Flooring: Resilient sheet flooring
   2. Walls: Plastic laminate on plywood or stainless steel.
   3. Front Return Panel: Stainless steel.
   4. Base: Resilient rubber cove or stainless wall panel.
   5. Ceiling: Translucent plastic pan or approved alternate.
   6. Light Fixtures: LED Minimum of five (5) foot candles at controls, platform, threshold and landing sill.
   7. Ventilation: Fan, grille in ceiling.
   8. Car Control Panel and Face Plate: Stainless steel with illuminating call buttons. If not otherwise indicated, mount in return panel adjacent to car door. Provide operating device symbols as required by current Code and with braille. Mark other buttons and switches with manufacturer's standard tactile identification and braille for required use or function. Main entry floor shall also be designated by a "star." Tactile markings shall be placed immediately to the left of the button to which they apply. Characters and symbols shall contrast with their background. Provide key switch for roof access.
   9. Car Position Indicator: Above door with illuminating "up" and "down" signal arrows or digital numeric display. Also provide an audible signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound once for up direction of travel and twice for down direction. Two and one-half (2½) inches minimum in the smallest dimension.
   10. Handrail: Stainless steel flat bar stock, spaced from wall one and one-half (1½) inches; placed at rear wall and side walls.

11. Bumper Rail: Stainless steel wrapped over wood, tight to wall; placed six (6) inches above floor at rear wall and side walls.
12. Pad Hooks: Stainless steel type.
13. Protective Pads: One (1) set, canvas cover, padded, brass grommets.
14. Certificate Frame and Glazing: Stainless steel frame, clear plastic.
15. Telephone: Provide rough-in for telephone handset in each car, contained in flush-mounted cabinet and complete with identification and instructions for use. The mounting height shall be a maximum of four (4) feet and shall be identified by a raised symbol adjacent to the device. Telephone shall automatically dial the City Number to be determined per job upon lifting. Stencil (paint) the name of the building and the project street address on the back side of the telephone access door.
16. Alarm System: Provide emergency alarm bell properly located within building and audible outside hoistway, equipped to sound automatically in response to emergency stops and in response to "Alarm" button on each car control station.
17. Provide "NO SMOKING" text on car control panel to match other text on panel. Provide "In Case of Fire Use Stairway" signs with appropriate graphic symbols and braille to match other text on panel.

B. Car Entrances:
1. Car Doors: Baked enamel on steel or stainless steel; of insulated sandwich panel construction, flush design, rolled profiles, rigid construction. Provide protective edge trim system.
2. Car Door Frames: Baked enamel on steel, welded corner design with smooth invisible joints.
3. Thresholds: Extruded aluminum type.

C. Hoistway Entrances:
1. Hoistway Doors: Baked enamel on steel; insulated sandwich panel construction, flush design, rolled profiles, rigid construction.
2. Hoistway Door Frames: Baked enamel on steel; of rolled profiles, welded corner with smooth invisible joints.
3. Door and Frame Construction: One and one-half (1½) hour fire rating.
4. Weatherstrip hoistway doors and frames to eliminate audible noise.
5. Sills: Extruded aluminum.
6. Jambs: Floor designation characters to be a minimum of two (2) inches high, raised one-thirty-second (1/32) inch, uppercase and corresponding Braille.

2.06 SIGNAL EQUIPMENT

A. General: Provide signal equipment for each elevator to comply with the requirements indicated below:
1. Provide illuminated hall car-call/landing buttons that light when activated and remain lit until call or other function has been fulfilled. Provide one for originating UP and one for originating DOWN calls, one button only at terminating landings. Fabrication of vandal-resistant translucent plastic. Call buttons to be three-quarter (¾) inch minimum in the smallest dimension; vertical button arrangement; flush or raised.
2. Car Direction Indicators: Illuminating white, minimum of two and one-half (2½) inches in smallest dimension. In conjunction with the car riding lantern device, provide an audible signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound once for up direction of travel and twice for down direction. Lantern must be visible from proximity of Hall Call button.

3. Door and Signal Timing for Hall Calls: Minimum of five (5) seconds between notification until doors begin to close.

B. Door Closing Time Delay: Minimum of three (3) seconds for doors to remain fully open in response to a call.

2.07 FACTORY FINISHING (ELECTRIC TRACTION PASSENGER ELEVATORS ONLY)

A. Baked Enamel on Steel: Clean and degrease metal surface; apply one (1) coat of primer sprayed and baked; two (2) coats of enamel sprayed and baked; color as selected.

B. Stainless Steel: #4 Satin Polished.

C. Aluminum: Clear anodized finish.

2.08 PERSONAL PROTECTIVE DEVICES

A. Door Edge Protective Device: Provide retractable edge shoe on leading edges of elevator entrance doors that causes doors to stop and reopen upon contacting an obstruction in entrance.

B. Photo-Eye Detection Device: Provide electronic photo-eye device with timed cutout, projecting dual light beams across car entrance at five (5) inch and two (2) feet, five (5) inch heights, that when interrupted will cause closing doors to stop and reopen. Provide keyed switch in car operating panel or toggle switch in service cabinet for disconnecting photo-eye protective device.

C. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time period, through activation of detection device or door edge protective device, a loud buzzer shall sound, and doors shall begin to close at reduced rate of speed. Doors shall continue to close unless door edge protective device is activated, which shall cause doors to reopen. Process shall repeat continuously until obstruction is removed from entrance.

2.09 ELEVATOR PIT LADDER

A. Fabrication: Provide an elevator pit ladder made of structural grade steel.

B. Code Requirements: Ladder shall meet applicable code requirements.

2.10 WORK BY THE GENERAL CONTRACTOR

A. To be determined on a project basis.

2.11 FAILURE PROTECTION

A. General Requirements: Design electrical control circuit so that if a malfunction should occur due to motor failure, power failure, or car failing to reach a landing in the “up” direction within a pre-determined time, the elevator car will automatically descend to lowest terminal landing (battery backup required). If power operated doors are used, doors will automatically open when car reaches that landing to allow passengers to depart. Doors will then automatically close and control buttons, except the “door open” button in car station, shall be made inoperative.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate all.

3.02 INSTALLATION

A. Install in accordance with manufacture’s recommendations.

B. Demonstration: Instruct Owner’s personnel in proper use, operations and daily maintenance of elevators and lift. Review emergency provisions, including emergency access and procedures to be followed at the 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. Confer with Owner on requirements for a complete elevator and lift maintenance program. Make a final check of each elevator with the Owner’s personnel present and just prior

to date of Substantial Completion. Determine that control systems and operating devices are functioning properly.

C. Provide Owner with remote diagnostic tool required to program the elevator.

END OF SECTION 14 20 00

DIVISION 21: Fire Suppression

21 05 00 – COMMON WORK RESULTS FOR FIRE PROTECTION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for fire protection. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. See Division 22 00 00 – Plumbing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Piping Installation

1. Arrange pipe in group runs where feasible. Coordinate locations with all trades. Avoid traps in piping.

END OF SECTION 21 05 00

21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for facility fire-suppression water-service piping. Additional requirements may be included within specific agreements or other contracting documents

B. Work involved with remodeling existing systems shall be done in accordance with NFPA-13. Provide new sprinkler heads in all locations where the existing head layout is altered. Verify existing piping arrangement, conditions, and locations at site before beginning fabrication.

1.03 SCHEDULING

A. All drawings and sprinkler calculations are subject to AHJ review and approval as well as the Architect/Engineer's before installation.

PART 2 – PRODUCTS

2.01 SIAMESE FIRE DEPARTMENT CONNECTIONS

A. Siamese connections. Threads shall be identical to those used in the city in which the system is being installed and shall meet the requirements of the AHJ.

2.02 FLOW ALARMS AND SUPERVISORY VALVE SWITCH

A. Provide Flow and Tamper switches in accordance with NFPA 13 and the Local Fire Department.

2.03 SPRINKLER SYSTEM

A. Automatic sprinkler system shall be designed by the Contractor for hazard indicated. Entire system shall be in accordance with NFPA and as specified herein and/or indicated. Contractor is herein given the option of sizing sprinkler system per pipe sizing tables in NFPA-13 or by the hydraulic method.
   1. Contractor is responsible for obtaining all necessary flow tests at site required for hydraulic calculations.
   2. System shall be dry or glycol filled and sized to avoid possible freezing when installed in an unconditioned space.

B. Hydraulic design methods shall conform to the methods outlined in NFPA No. 13.

C. Prior to starting fabrication or installation of sprinkler system, Contractor shall submit detailed one-eighth (1/8) inch scale (minimum) shop drawings, stamped "Reviewed" by agency having jurisdiction, to Architect/Engineer for review and approval. At time of completion of work, obtain certificate of inspection and approval from same agency.

D. In rooms and/or spaces where sprinkler head locations are not indicated, locate sprinkler heads to avoid conflicts with other pieces of equipment such as lights, speakers, diffusers, etc., located in ceiling. Consult Architectural, Mechanical, or Electrical plans carefully to avoid conflicts.

E. System shall be provided complete with water supply connection, sprinklers, all piping, fittings, valves, seals, test connections, hangers, supports, sleeves, escutcheons, drain valves, test connections, signs, diagrams, etc., all as required for a complete and operating system. All drain and test valves must be ball valves. Provide drain valves at all low points.

F. Fire Sprinklers:

1. All sprinklers shall be automatic closed spray type sprinkler heads of ordinary degree temperature rating except where excess temperatures are anticipated; heads shall be of higher rating.
2. Sprinkler heads installed in areas which do not have suspended ceilings shall be of brass upright type. Sprinklers shall be installed with consideration being given to all ductwork, piping, etc., and heads shall be located above and/or below ductwork as required by NFPA Standards.
3. Sprinkler head protections to be installed when damage could occur.
4. Sprinkler heads installed in areas which have suspended ceilings shall be of the concealed sprinkler type with flat white cover plate.
    a. Braided stainless steel flex heads may be used.
    b. Corrugated flex heads are not allowed.
5. Side wall sprinkler heads indicated shall be provided in finishes that are provided by the Architect.
6. Provide stock of spare heads, of each type installed, packed in a suitable cabinet. Number of each type of spare heads to be provided shall be as indicated in NFPA-13. The cabinet shall contain at least two (2) sprinkler head wrenches.
7. Upright sprinklers located as to be subject to mechanical injury shall be protected with approved guards.

2.04 BACKFLOW PREVENTER

A. Shall be double check type.
B. Two independent "Y" type spring-loaded ductile check valves, two (2) OS&Y shut-off valves, and four (4) test clocks.
C. With stainless steel center-guided checks with soft elastomer discs for drip-tight closure against backflow.
D. UL-listed for fire line service.
E. Backflow preventer to be full line size.
F. Febco Model 850 C. All other types of backflow preventors must be approved by Owner.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 21 11 00

DIVISION 22: Plumbing

22 05 00 – COMMON WORK RESULTS FOR PLUMBING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for plumbing. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Contractor shall be responsible for the quality and workmanship of all plumbing products, equipment, and systems. Costs associated with repair and/or reinstallation due to poor quality and/or workmanship shall be borne by the Contactor.

PART 2 – PRODUCTS

2.01 PIPE AND FITTINGS

A. Standpipe and Fire Sprinkler Piping:
   1. Standpipe piping shall be black steel, Schedule 40, screwed, or grooved with mechanical joints, UL approved, one hundred-seventy-five (175) pound working pressure.
   2. Fire sprinkler piping shall be black steel, Schedule 40 or other as approved by Owner.

B. Miscellaneous drain lines receiving cooling coil condensate, drip for humidifiers, etc.:
   1. Piping shall be Type "L" copper, fittings wrought copper, solder joint; or approved equal.

C. Compressed air piping in building above ground (shop air):
   1. Piping shall be type "L" hard copper with wrought copper or cast brass fittings.

D. Refrigeration Piping:
   1. Piping shall be ACR hard drawn copper tubing cleaned, dehydrated and sealed. Use soft drawn dehydrated and sealed seamless copper tube where bending is required except where subject to physical damage. Fittings wrought copper solder fittings.
   2. Joints: Support piping as required to prevent damage to pipe. Run nitrogen through pipes one (1) inch and larger when silver soldering.

E. Art Classrooms: Provide adequate solids interceptors to collect clay particles. Provide union connections on inlet and outlet of interceptors.

F. Provide standard weight IPS brass nipples and adapters where required between copper tubing and fixtures. Steel, galvanized or iron nipples are not permitted between copper lines and brass valves or trim.

G. Joints: Joints in all copper domestic piping systems shall be made using 95/5 tin/antimony or equal tensile strength solder. Use flux recommended by solder manufacturer. Owner reserves the right to inspect solders, fluxes and joints.

H. All copper tubing to be reamed to full inside diameter of the tubing.

I. T-drill, Shark Bit Fittings, Copper Grooved, Grooved fittings are not acceptable in hydronic, chilled, or domestic water systems.

PART 3 – EXECUTION

3.01 PREPARATION

A. Excavating, Trenching, Backfilling
   1. Excavation: Trenches for all underground pipelines shall not be carried below the required depths except as necessary for special pipe bedding or to remove unstable soil or rock.
   2. Provide tracer wire along all lengths of underground piping.

3.02 INSTALLATION

A. Piping Installation
   1. Install piping in straight runs. Reamed to full size after cutting. Remove all chips from reaming.
   2. Arrange pipe in group runs where feasible. Coordinate locations with all trades. Avoid traps in piping.
   3. Install piping to facilitate thermal expansion of pipe. Provide anchors and guides to control direction of travel. Provide ample length to maintain twenty-five percent (25%) engagement with maximum pipe travel.
   4. Expansion loops shall be used for expansion compensation.

B. Existing Insulation Repair
   1. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during the construction period. Use insulation, install new jacket lapping and sealed over existing.

C. Workmanship
   1. Poor workmanship of any installed products, equipment, or systems must be repaired and/or reinstalled as directed by the Owner. All work must be verified and approved by Owner prior to project completion.

3.03 CLEANING AND PROTECTION

A. Disinfecting and Special Cleaning
   1. When a new system is to be connected to an existing system, isolate the new system for cleaning and flushing if applicable. Reaming chips must be removed by flushing, cleaning strainers, etc.

B. Testing
   1. After completion of Work visually observe all plumbing piping to ensure no leaks or other deficiencies are observed.

END OF SECTION 22 05 00

22 05 19 – METERS AND GAUGES FOR PLUMBING PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes meters and gauges for plumbing piping. Additional requirements may be included within specific agreements or other contracting documents.
- B. Comply with MSS-SP-92, Valve User's Manual.

PART 2 – PRODUCTS

2.01 PRESSURE GAUGES
- A. Pressure Gauges: Type, location and design of the system to be designed, reviewed, and approved by the Architect/Engineer and Owner.

2.02 THERMOMETERS
- A. Painted vertical metal case at least eight (8) inches long with a glass or Lucite face.
- B. Furnish and install thermometers in pipelines and equipment as scheduled and/or indicated. 9-inch scale with separable socket, cast aluminum case, red reading mercury, adjustable industrial type complete with thermometer wells. Scale range shall be thirty (30) degrees Fahrenheit to two hundred-forty (240) degrees Fahrenheit with two (2) degree divisions.
- C. Thermometer installation will not be accepted unless easily read by an operator standing on the floor.
- D. Bottom or back pipe thread connection.
- E. Use thermal wells with heat transfer enhancement compound in piping services.
- F. Range: At least fifty percent (50%) higher than the highest expected temperature of the service and at least twenty (20) degrees lower than the lowest expected temperature.
- G. Accuracy: One percent (1%) of full scale or better.

2.03 PRESSURE AND TEMPERATURE SENSING PLUGS*
- A. Provide where indicated one-quarter (¼) inch NPT fitting to receive either a one-eighth (1/8) inch O.D. temperature or pressure probe. Fittings shall be brass with valve core suitable for two hundred-seventy-five (275) degrees Fahrenheit. Plugs shall be complete with gasketed cap and units shall be rated for one thousand (1000) psi.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Special Devices
  1. Install a pressure-temperature tap on each side of each pump and heat transfer device such as coils, heat exchangers, radiators and radiant panels.
  2. Install one hydronic balancing valve as defined above in series with each air handling unit coil, heat exchanger, each section of fin tube radiators or radiant panels. A section is defined as assembly controlled by one stat/temperature control valve combination. Provide isolation valves on each side of control valve. Circuit setters are not to be used as isolation valves.

3. Expansion tanks, air separators and other devices heavier than two hundred (200) pounds may not be suspended from overhead without written permission from the Structural Engineer.
4. Provide a wrench operated main gas shut off valve, for Fire Department use, outside the building and upstream of the meter. Coordinate with Owner for location and who provides valve.
5. Flow (paddle) switches shall be used where required to prove flow through low head pumps, usually boiler and coil circulators. The Architect/Engineer shall carefully and fully detail flow switch installation. Provide isolation valves on both sides of flow switches.

3.02 IDENTIFICATION

A. Label all mechanical devices in accordance with ANSI Standards.
B. Label all valves with tags indicating service and number along with QR code. Tags one and one-quarter (1½) inch in diameter, brass, with one-quarter (¼) inch high black letters. Securely fasten with chain and hook. Match service abbreviations given on mechanical drawings. Show all valve tag numbers on red line drawings at valve locations. All valves located behind access panels or located above ceiling tiles are to be labeled per section 22 05 53 2.02, D, 4.
C. Provide a permanent nameplate attached to acoustical tile ceiling grid identifying device above the ceiling. No handwritten or other markings allowed.
D. Do not paint or insulate over nameplates.
E. Label mechanical equipment with four (4) inch by six (6) inch engraved plastic laminate signs with one (1) inch high letters.

3.03 TESTING

A. Test all operating devices. Keep records of all tests, at minimum: the date of the test, system or subsystem tested; test medium and pressure used; duration of test; test results; name and signature of individual performing test.
B. Images

END OF SECTION 22 05 19

22 05 23 – GENERAL-DUTY VALVES AND UNIONS FOR PLUMBING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes general-duty valves and unions for plumbing. Additional requirements may be included within specific agreements or other contracting documents.

B. Comply with MSS-SP-92, Valve User's Manual.

PART 2 – PRODUCTS

2.01 VALVES

A. Provide shut-off valves in lines serving each piece of equipment such as wall hydrants and sill cocks.

B. Provide isolation valves on each side of equipment such as mixing valves, control valves, circuit setters, pumps, coils, water heaters, plumbing fixtures, eyewash stations, etc. Also isolate each major zone, building wing, loop, etc. Circuit setters are not to be used as isolation valves. Provide isolation valves on all branches off mains.

C. Provide isolation valves to separate specific systems, spaces, and portions of buildings. Coordinate with the Owner.

D. Valve Schedule: All valves shall be ball valves unless otherwise noted.

1. Shut-off valves for domestic water, compressed air and heating water shall be full flow ball valves, rated at six hundred (600) psig WOG.
2. Where ball valves are used in insulated piping, handle extensions shall be provided. Extension shall be manufactured as an option for the valve furnished and shall extend the handle a minimum of one-quarter (¼) inch beyond the insulation jacket. Handles cannot be altered to allow for insulation.
3. Swing check valves shall be spring type, bronze, with swing regrinding seat and renewable disc. Class 125.
4. Balance valves for domestic water and heating water shall be rated at two hundred (200) psig minimum working pressure, two hundred-fifty (250) degrees Fahrenheit minimum working temperature. The body shall be bronze with pressure differential ports, positive shut-off and memory stop.
5. Balance valves are not to be used as isolation valves.
6. Drain valves shall have one-half (½) inch garden hose threaded adapter with cap, ball valve only, and vacuum breaker installed.
7. Shut-off valves for gas shall be eccentric plug valve ball, double seal seats, and seal, rated one hundred-seventy-five (175) pound WOG.
8. Any hose bib or hose thread connection must have vac. breaker.

E. No copper alloy in steam or condensate services.

F. Globe valves for steam or condensate service: Cast steel bodies, stainless steel plugs and satellite seats.

G. UL and FM list valves intended for fire protection service.

H. Natural Gas Service: Iron body lubricated plug type with lever or gear operators.

I. Hydronic Balancing Valves: Integral flow measuring taps, memory set, and locking indicating handles.
J. Freeze proof wall hydrants for outdoor service.
K. UL list solenoid valves intended for fuel gas shut off.
L. Butterfly: Full flanged or lug— no wafers. All butterfly valves are to have gear operators.

2.02 UNIONS

A. Install per design specifications and industry best practices.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Valving
   1. Provide valves on all water and gas piping lines before they enter and after they leave a basement, crawl space or trench. Install shut off valves for all plumbing groups. Install an accessible wrench operated plug valve on the gas main outside before it enters the building.

END OF SECTION 22 05 23

22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING, PIPING, AND EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for hangers and supports for plumbing, piping, and equipment.
   1. Horizontal-piping hangers and supports.
   2. Vertical-piping clamps.
   3. Hanger-rod attachments.
   4. Building attachments.
   5. Saddles and shields.
   6. Spring hangers and supports.
   7. Miscellaneous materials.
   8. Roof equipment and supports.
   9. Anchors.
   10. Equipment supports.

B. Additional requirements may be included within specific agreements or other contracting documents.

C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.03 SUBMITTALS REQUIRED

A. Shop Drawings.

B. Product Certificates.

C. Maintenance Data.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide pipe hangers, supports, anchors, and guides as specified herein, conforming to current plumbing code. Locate at changes in direction and at concentrated loads. Hanger design shall permit vertical adjustment and lateral movement to allow pipe expansion. Double nut hangers where piping is subject to water hammer, i.e. near flush valves and solenoid valves. All insulated pipe will have insulation inserts with shield at all hanger locations.

B. Bear hot piping directly on hangers or on insulation shields and cold piping on insulation, shielded as described under article for insulation. All insulated pipe will have insulation inserts with shield at all hanger locations.

C. Provide pipe hangers of ample diameter for cold piping insulation and vapor barrier jacket.

D. Use carbon steel adjustable hangers as follows:
   1. Steel/cast iron, two and one-half (2½) inches and larger.

2. Steel and cast iron, two (2) inches and smaller.
3. Copper pipe two (2) inch and smaller.
4. Plastic, one (1) inch and smaller.

E. Hanging from one pipe to another is prohibited.

2.02 PIPE HANGERS AND SUPPORTS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with all applicable codes and standards.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 22 05 29

22 05 48 – VIBRATION AND SEISMIC CONTROL FOR PLUMBING AND EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for vibration and seismic control for plumbing and equipment.
   1. Neoprene pads.
   2. Vibration isolation springs.
   3. All-directional anchors.
   4. Neoprene mountings.
   5. Spring isolators, free-standing.
   6. Spring isolators, vertically restrained.
   7. Thrust restraints.
   8. Fabricated equipment bases.
   9. Isolation hangers.
   10. Flexible pipe connectors.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of vibration control products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than five (5) years.
   1. Obtain vibration control products from a single manufacturer.
   2. Engage the manufacturer to provide technical supervision of installation of support isolation units produced, and of associated inertia bases (if any).

PART 2 – PRODUCTS

2.01 VIBRATION CONTROL MATERIALS AND SUPPORT UNITS

A. Neoprene Pads: Oil-resistant neoprene sheets of manufacturer's standard hardness and cross-ribbed or waffled pattern.

B. Vibration Isolation Springs: Wound-steel compression springs, of high-strength, heat treated, spring alloy steel with outside diameter not less than 0.8 times operating height; with lateral stiffness not less than vertical stiffness and designed to reach solid height before exceeding rated fatigue point of steel.
   1. Color coated springs for ease of identification.
   2. Spring shall have a minimum of fifty percent (50%) additional travel to solid.

C. Neoprene Mountings: Provide neoprene mountings consisting of neoprene element bonded between two (2) steel plates that are neoprene-covered to prevent corrosion. Provide minimum rated deflection of 0.35-inch. Provide threaded hole in upper plate and two (2) holes in base plate for securing to equipment and to substrate.

D. Spring Isolators, Free-Standing: Provide vibration isolation spring Type C between top and bottom loading plates, and with pad-type Type B isolator bonded to bottom of bottom loading

plate. Include studs or cups to ensure centering of spring on plates. Include leveling bolt with lock nuts and washers, centered in top plate, arranged for leveling and anchoring supported equipment as indicated.
    1. Include holes in the bottom plate for bolting unit to substrate as indicated.
E. Spring Isolators, Vertically Restrained: Provide spring isolators Type C in housing that includes vertical limit stops. Design housing to act as blocking during erection, and with installed height and operating height being equal. Maintain one-half (½) inch minimum clearance around restraining bolts, and between housing and springs. Design so limit stops are out of contact during normal operation.
    1. Mounting used out of doors shall be hot dipped galvanized, spring shall be cadmium plated.
    2. Mounting used out of doors shall have certified calculation by a registered professional engineer showing ability to withstand one hundred-nine (109) miles per hour wind load in three (3) principal axis.
F. Thrust Restraints: Provide horizontal thrust restraints consisting of spring elements in series with neoprene pad. Select spring deflection same as for equipment loading. Design so thrust restraints can be pre-set and adjusted in field. Attach horizontal restraints at centerline of thrust and symmetrically on either side of unit.
    1. Provide same deflection as isolated equipment.
    2. Select load to provide one-quarter (¼) inch maximum displacement under full system operating pressure.
G. Isolation Hangers: Hanger units formed with brackets and including manufacturer's standard compression isolators. Design brackets for five (5) times rated loading of units. Fabricate units to accept misalignment of fifteen (15) degrees off center in any direction before contacting hanger box, and for use with either rod or strap type members and including acoustical washers to prevent metal-to-metal contacts.
    1. Provide vibration isolation spring Type C with cap in lower pad-type isolator rubber hanger element in bottom, securely retained in unit.
    2. Provide neoprene element, with minimum deflection of 0.35-inch, securely retained in a hanger box.
H. Riser Isolators: Suspend risers from, or support risers by, spring hangers Type ND or spring isolators Type F. Wherever possible, anchor risers at central point with resilient anchors, Type D. Provide hanger or mounting deflection of 0.75-inch except in those expansion locations where additional deflection is required to limit deflection or load changes to +twenty-five (+25%) of initial deflection. Provide sliding guides held in position by resilient anchors, located between anchor points and end of piping.
I. Flexible Pipe Connectors:
    1. For non-ferrous piping, provide bronze hose covered with bronze wire braid with copper tube ends or bronze flanged ends, braze-welded to hose.
    2. Flexible Pipe Connectors: Provide EDPM construction consisting of multiple plies of nylon tire cord fabric and elastomer molded and cured in hydraulic rubber presses.
    3. Provide straight connector, rated at one hundred-twenty-five (125) psi at two hundred-twenty (220) degrees Fahrenheit (one hundred-four (104) degrees Celsius).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Examination of Related Work

1. Installer of vibration isolation work shall observe installation of other work related to vibration isolation work, including work connected to vibration isolation work; and, after completion of other related work (but before equipment startup), shall furnish written report to Engineer listing observed inadequacies for proper operation and performance of vibration isolation work. The report shall cover, but not necessarily be limited to the following:
    a. Equipment installations (performed as work of other sections) on vibration isolators.
    b. Piping connections including flexible connections.
    c. Ductwork connections including provisions for flexible connections.
    d. Passage of piping and ductwork which is to be isolated through walls and floors.
2. Do not start-up equipment until inadequacies have been corrected in manner acceptable to vibration isolation installer.

B. Deflection Measurements
1. Upon completion of vibration isolation work, prepare a report showing measured equipment deflections theoretical floor deflection and isolation efficiency for each major item of equipment.

3.02 CLEANING AND PROTECTION

A. Adjusting and Cleaning
1. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short- circuit unit isolation.

END OF SECTION 22 05 48

22 05 53 – IDENTIFICATION FOR PLUMBING, PIPING, AND EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for identification for plumbing, piping, and equipment.
  1. Plastic pipe markers.
  2. Plastic tape.
  3. Plastic duct markers.
  4. Valve tags.
  5. Engraved plastic-laminate signs.
  6. Equipment markers.
  7. Plasticizes tags.
  8. QR codes and barcodes.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Schedules.

1.04 QUALITY ASSURANCE
- A. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Material: Material(s) shall be UV resistant and resistant to wear.

PART 2 – PRODUCTS

2.01 PLASTIC PIPE MARKERS
- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers.

2.02 PLASTIC TAPE
- A. Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than three (3) MILs thick.

2.03 VALVE TAGS
- A. Valve Tags: Provide durable tags at each valve.
- B. Identify all valves located above ceilings or behind access panels. Provide a permanent nameplate attached to acoustical tile ceiling grid identifying device above the ceiling. No handwritten or other markings allowed.

2.04 EQUIPMENT IDENTIFICATION
- A. For mechanical equipment exposed to view throughout the building, located in mechanical rooms or on the roof, provide equipment identification. Provide a permanent means of attachment.

2.05 PLASTICIZED TAGS

A. Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing and with appropriate pre-printed wording including large- size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.06 LETTERING AND GRAPHICS

A. Provide numbers, lettering and wording as indicated and approved by the Owner and or Architect/Engineer for proper identification and operation/ maintenance of mechanical systems and equipment.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General Installation Requirements
   1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification
   1. Install pipe markers of the following type on each system and include arrows to show normal direction of flow.
   2. Plastic Pipe Markers: Install on pipe insulation segment where required for hot non-insulated pipes.
   3. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   4. Near each valve and control device.
   5. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   6. Near locations where pipes pass through walls or floors/ceilings or enter non-accessible enclosures.
   7. At access doors, manholes and similar access points which permit view of concealed piping.
   8. Near major equipment items and other points of origination and termination.
   9. Spaces intermediately at maximum spacing of twenty-five (25) feet along each piping run, except reduce spacing to fifteen (15) feet in congested areas of piping and equipment.
   10. On piping above removable acoustical ceilings.

C. Valve Identification
   1. Provide valve tag on valves in each piping system. List each tagged valve in valve schedule for each piping system. List valve tag locations on redline drawing at location of valves.
      a. Building services main shut-off valves.
      b. Each individual system main shut-off valves.
      c. Each individual system floor shut-off valves.
      d. Each individual system major branch shut-off valves.
   2. Mount valve schedule frames and schedules in mechanical equipment rooms where directed by Owner.

3.02 CLEANING AND PROTECTION

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

END OF SECTION 22 05 53

22 07 16 – PLUMBING EQUIPMENT INSULATION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMETS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for plumbing equipment insulation.
  1. Equipment insulation:
     a. Fiberglass.
     b. Calcium silicate.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Samples.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Installation of Equipment Insulation
  1. Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
  2. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
  3. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of aluminum jacketing, as recommended by manufacturer.

END OF SECTION 22 07 16

22 11 13 – FACILITY WATER DISTRIBUTION PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for facility water distribution piping.
   1. Piping System Insulation: Fiberglass.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Shop Drawings.

C. Certification of Completion.

D. Test Reports.

E. Manufacturer Data.

F. Maintenance Data.

1.04 QUALITY ASSURANCE

A. Welding Materials and Procedures: Conform to ASME BPV SEC IX, except to conform to ANSI/ASME B31.1 for systems with operation temperature over two hundred-fifty (250) degrees Fahrenheit (one hundred-twenty-one (121) degrees Celsius).

PART 2 – PRODUCTS

2.01 PIPE AND TUBE MATERIALS

A. Water service and water in building underground including service to fire riser:
   1. Piping three (3) inches and larger shall be ductile-iron, AWWA C-15076, with cement mortar lining. Fittings: Cast iron, conforming to ASA 21.10, cement mortar lined. Join pipe and fitting with mechanical fittings.
   2. Piping two and one-half (2½) inch and smaller, Type "K" soft drawn copper water tube. Fittings: wrought copper, silver brazed. There shall be no buried fittings under the building.

B. Domestic Water Distribution Piping:
   1. All unnecessary traps in circulating lines shall be avoided.
   2. All water pipe underground outside of building shall be buried a minimum of five (5) feet deep. Where waste and water piping are run in the same trench, installation shall conform to all governing codes. Install tracer wire on all exterior utilities. Terminate in an approved termination box.

2.02 SPECIAL DUTY VALVES

A. Balance Cocks: 400 PSI WOG, two (2) piece, ball valve, handle, memory stop. Balance cocks are not to be used as isolation valves.

B. Balance Cocks: Flow measuring valves shall consist of a three hundred (300) psi rated ball valve with bronze body, chrome plated ball, teflon seats and heavy-duty steel handle with vinyl grip. The venturi section of the valve shall be integrally designed with the ball section and sized for maximum flow accuracy and pressure recovery. The flow section shall be furnished with two

dual-core temperature/pressure taps with color coded removable retained safety cap assemblies. The unit shall have a ground-joint union especially designed for minimum turbulence and to allow for full service. Valves shall be furnished with shipping/insulation sleeve for ease of access to the temperature/pressure test ports and also to allow adjustments of the valve handles without removing the insulation. Balance cocks are not to be used as isolation valves.

2.03 PIPING SPECIALTIES

A. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for two hundred-fifty (250) psi, tested and certified.
   1. Install water hammer arresters with isolation valve in accessible location.
   2. Provide lockable access doors located in accordance with architectural recommendations.
B. Hose Bibbs:
   1. Unfinished and Equipment Rooms: Rough chrome plated bronze body, renewable composition disc, tee handle, three-quarter (¾) inch NPT inlet, three quarter (¾) inch hose outlet.
   2. Finished Rooms with Floor Drains: Concealed box type hose bib, polished chrome plated bronze body, with renewable composition disc, tee handle, three-quarter (¾) inch NPT inlet, three-quarter (¾) inch hose outlet, backflow protected.
C. Wall Hydrants:
   1. Concealed Box-Type Type Non-Freeze Wall Hydrant: All brass with polished bronze face plate, "T" handle loose key, integral vacuum breaker, self-draining body and shank, three-quarter (¾) inch male hose thread outlet, three-quarter (¾) inch male or female thread inlet, renewable seat; shank length to extend thru primary exterior wall sufficient distance to prevent freezing.
   2. Reduced Pressure Type: All bronze (three-quarter (¾) inch to two (2) inch)/ductile iron (two and one-half (2½) inch to ten (10) inch) body with two independently operating, spring loaded check valves and one differential relief valve with automatic intermediate atmospheric vent. Pressure in intermediate zone to activate relief valve when there is a two (2) psig. differential between the zone and the upstream side of the first check valve. The relief valve shall remain open until a positive pressure differential is re-established. Assembly to be furnished with fullport, positive shut off isolation valves, in-line strainer, union connections, funnel, and all test cocks.
D. Pressure Reducing Valves – Air/Water (Direct Acting):
   1. Low and High Capacity (fifteen (15) to one hundred-twenty (120) GPM): All bronze pressure reducing valves, sensitive spring and diaphragm for accurate pressure control; manual adjustment for outlet pressure integral strainer, female thread connections. See details on mechanical plans for size, capacity and piping arrangement.
E. Thermostatic Mixing Valves:
   1. Exposed Type: Bronze thermostatically controlled mixing valve with stainless steel piston, fail safe automatic shut-down if either hot or cold-water pressure fails; union connection, polished chrome finish.
F. Pressure/Temperature Relief Valves (PTRV):
   1. Fully automatic, all bronze pressure/temperature relief valve with test lever and extension thermostatic element; temperature relief setting at two hundred-ten (210) degrees Fahrenheit and pressure setting at one hundred-fifty (150) psig; valve to meet ASME Standards. Relief opening to be piped to an indirect connection at nearest floor drain.

2.04 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

A. Aquatherm piping is preferred. Alternatives must be approved by Owner.

2.05 HEAT PUMP PIPING, BURIED

A. Pipe and Fittings
   1. Piping shall be PVC piping. There shall be no buried fittings under the building.
   2. Follow manufacturer's recommendations and instructions.

2.06 HEAT PUMP PIPING, ABOVE GROUND

A. Pipe and Fittings
   1. Aquatherm piping preferred. Alternatives must be approved by Owners.

2.07 HEATING WATER AND CHILLED PIPING

A. Aquatherm piping preferred. Alternatives must be approved by Owners.

2.08 GASKETS

A. Thickness, material type suitable for fluid to be handled, design temperatures, and pressures.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.
C. Do not proceed until unsatisfactory conditions have been corrected.
D. Ream pipe and tube ends. Remove burrs. Bevel plain and ferrous pipe. If pipe at any point in the project is found not reamed, contractor may be required to disassemble all piping installed and have a third (3rd) party (approved by Architect/Engineer and Owner) verify reaming is complete. Costs for destructive research, whether more areas are found defective or not, shall be the responsibility of the contractor.
E. Remove scale and dirt on inside and outside before assembly.
F. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
G. After completion, fill, clean, vent, and chemically treat systems.

3.02 INSTALLATION

A. Piping Installation
   1. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
   2. Install piping to conserve building space, and not interfere with use of space and other work.
   3. Do not install underground piping when bedding is wet or frozen.
   4. Group piping whenever practical at common elevations.
   5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
   6. Provide clearance for installation of insulation and access to valves and fittings.
   7. Provide access where valves and fittings are not exposed.
   8. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level, for hydronic systems; bottom of pipe level for steam and refrigeration systems.
   9. Where pipe support members are welded to structural building framing, scrape, brush, clean, and apply one coat of zinc to rich primer to welds.
   10. Prepare pipe, fittings, supports, and accessories, for finish painting.
   11. Install valves with stems upright or horizontal, not inverted.

12. Install polyethylene tape on buried fittings and joints, extending four (4) inches (one hundred (100) millimeters) each side of fitting or joint. Clean area to receive tape with solvent.

B. Hot Water Heating Systems
   1. The hot water heating system shall have manual air vents at all high points and at all points where drops occur in lines. Actual locations of manual air vents shall be marked on As Built Drawings.

C. General Application
   1. Install union downstream of valves and at equipment or apparatus connections.
   2. Install ball or butterfly valves for shut-off and to isolate equipment part of systems.
   3. Install plug valve, ball valve, or butterfly valve for balancing/throttling, bypass, or manual flow control services; however, ball valves shall be specifically shown in manufacturer's published product data as being suitable for continuous throttling.
   4. Provide spring loaded non-slam check valves.
   5. Use butterfly valve operators as follows:
      a. All sizes to have gear operators.
      b. Provide three-quarter (¾) inch (twenty (20) millimeter) ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest drain.

D. Valve Applications
   1. General Duty Valve Applications:
      a. Shut-off: Use ball valves only.
      b. Throttling Duty: Use globe and ball valves.

E. Installation of Valves
   1. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves two (2) or more plumbing fixtures or equipment connections. For sectional valves two (2) inches and smaller, use ball valves; for sectional valves two and one-half (2½) inch and larger, use ball valves only.
   2. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture. For shutoff valves two (2) inches and smaller, use ball valves; for shutoff valves two and one-half (2½) inch and larger, use ball valves only.
   3. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system. For drain valves two (2) inch and smaller, use ball valves; for drain valves two and one-half (2½) inch and larger, use ball valves only. All drains that are not piped to a drain are to have a three-quarter (¾) inch hose connection with chain and cap.
   4. Check Valves: Install swing check valves on discharge side of each pump.
   5. Balance Valve: Install in each hot water recirculating loop, discharge side of each pump. Balance valves are not to be used as isolation valves.
   6. Hose Bibbs: Install on exposed piping, with vacuum breaker.
   7. Wall Hydrants: Install with vacuum breaker. All hose bibs are to have an isolation valve installed for maintenance and repairs.

F. Installation of Piping Specialties
   1. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in the same room as equipment being connected. Pipe relief outlet through air gap and without valves, full-size to nearest floor drain. Provide floor drain at each backflow preventer, size as

required to meet backflow. (i.e., one (1) inch device requires two (2) inch drain; two (2) inch device requires four (4) inch drain.
2. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gauge on valve outlet. Provide unions on both sides of PRV.

G. Equipment Connections
1. Mechanical Equipment Connections: Provide shutoff valve and union for each connection, provide drain valve on drain connection. For connections two and one-half (2½) inch and larger, use flanges instead of unions.

H. Field Quality Control
1. Inspections: Inspect water distribution piping. Notify Owner at least forty-eight (48) hours prior to any inspections. Include Owner in inspection activities.

I. Hose Bibbs and Wall Hydrants:
1. Locations:
a. Each mechanical room where there is cold potable water service.
b. Inside Kitchen.
c. Locker rooms.
d. Shower rooms.
e. Mechanical rooms, if heated.
f. Boiler room.
g. Wall hydrant every two hundred (200) feet of exterior perimeter
h. Wall hydrant outside at the kitchen service entrance.
i. Custodial closets.
2. Provide freeze-proof outside wall hydrants with inside ball and drain valves in heated areas for winter shut off.

J. Minimum Locations of Floor Drains:
1. Mechanical rooms.
2. Kitchen.
3. Every toilet room.
4. Locker rooms.
5. Showers.
6. Emergency showers and eyewash stations.
7. Custodial closets.
8. All backflow preventer locations.

3.03 CLEANING AND PROTECTION

A. Adjusting and Cleaning
1. Flushing and cleaning of water distribution piping shall be witnessed by the Owner. Provide minimum of twenty-four (24) hours' notice prior to performing work.
2. Clean and disinfect water distribution piping as follows:
a. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
b. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure as described below:
i. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
ii. Fill the system or part thereof, with a water/chlorine solution containing at least fifty (50) parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for twenty-four (24) hours.

iii. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least two hundred (200) parts per million of chlorine and isolate and allow to stand for three (3) hours.
iv. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming for the system.
v. Submit water samples in sterile bottles to the AHJ. Repeat the procedure if the biological examination made by the AHJ shows evidence of contamination.

3. Prepare reports for all purging and disinfecting activities.
4. Domestic Water Systems:
   a. All new potable water systems shall be cleaned as herein specified prior to testing or application of insulation.
   b. Procedure: Comply with Owner standards or Colorado State Department of Health requirements, whichever is more stringent.
   c. Report: The report shall contain the following and be submitted to the Owner within twenty-four (24) hours of the cleaning:
      i. Date, time, and place of cleaning.
      ii. Duration.
      iii. Person responsible.
      iv. Solutions concentration and temperature.
      v. Signature of State Department of Health representative.
      vi. Results.
5. Heating Water System:
   a. Notification: Notify Owner twenty-four (24) hours in advance of the beginning of the cleaning process. The cleaning process will not be deemed acceptable unless witnessed and approved by Owner. This shall be a requirement for final payment.
   b. Procedure: Flush all systems with clean city water until the discharge is clear. Clean or replace the baskets of all strainers after cleaning.
   c. Drain system, and fill system with clean water, mixed with propylene glycol with inhibitors to thirty percent (30%) by volume. If there is excess propylene glycol, turn remaining over to Owner.

END OF SECTION 22 11 13

22 11 23 – FACILITY NATURAL GAS PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for facility natural gas piping.
   1. Distribution piping systems for natural gas and manufactured gas within the building and extending from the point of delivery to the connections with gas utilization devices.
   2. Piping materials and equipment specified in this section include:
      a. Pipes, fittings, and specialties.
      b. Special duty valves.
   3. This section does not apply to LP-gas piping; industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen and nitrogen; gas piping, meters, gas pressure regulators and other appurtenances used by the serving gas supplier in distribution of gas.
   4. Gas pressures for systems specified in this section are limited to low pressure.
   5. Products installed but not furnished under this section include gas meters which will be provided by the utility company, to the site, ready for installation.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Not less than five (5) years.

B. Installer Qualifications: Minimum of five (5) previous projects similar in size and scope to this project.

PART 2 – PRODUCTS

2.01 PIPE, TUBING AND JOINTING MATERIALS

A. Natural gas in building above ground:
   1. Piping shall be black steel, Schedule 40, plain ends for welding for two and one-half (2½) inches and above. Fittings welded, standard weight. Joints welded as recommended by AWS or NCPWB.
   2. For two (2) inches and smaller, piping shall be black steel, Schedule 40, screw ends. Fittings black malleable iron screwed; standard weight one hundred-fifty (150) pound banded. Minimize gas piping inside the building by running pipe on the roof wherever possible. Support pipe on roof with premanufactured tested and certified pipe supports, or as per manufacturer's recommendations for single ply membrane roofs. Entire pipe shall be primed and painted by the painting contractor to prevent rusting. Support pipe at ten (10) foot intervals for one and one-quarter (1¼) inch pipe and larger, and at eight (8) feet. intervals for three-quarter (¾) inch or one (1) inch pipe. Pipe installed in a return air plenum must be welded. No screwed fittings.

B. Natural and LP gas buried in ground:
   1. Polyethylene pipe (PLEXCO Yellow pipe PE 2406 or approved equal) with iron pipe transition risers. Install tracer wire in trench above poly pipe before backfilling.

2. OR piping shall be Schedule 40, plain ends for welding. Fittings welded, standard weight. Joints welded as recommended by AWS or NCPWB. Tape all joints and mill wrap all pipe and fittings.
3. Add isolation valves at specific pressure required.

2.02 NATURAL GAS PIPING SPECIALTIES

A. Protective Coating: Provide factory applied polyethylene tape.
B. Flexible Connectors: Corrugated Type 304 stainless steel flexible pipe with stainless steel braid and heavy flexible armor shield.

2.03 VALVES

A. Special duty valves are specified in this section by their generic name.
B. Gas Cocks Two (2) Inches and Smaller: One hundred-fifty (150) psi WOG, bronze body, straightaway pattern, square head, threaded ends.
C. Gas Cocks Two and One-Half (2½) Inch and Larger: MSS SP-78; one hundred-seventy-five (175) psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.
D. Gas Line Pressure Regulators: Single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for two (2) inches and smaller, flanged ends for two and one-half (2½) inches and larger; for inlet and outlet gas pressures, specific gravity, and volume flow. Provide gas cocks and unions on both sides of regulators.
E. Gas Safety Valves: Gas safety valve latched open when energized, free handle design, manual reset, and a visual position indicator.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of Pipe
1. Gas Piping (Natural):
a. All gas piping shall be installed with plugged drip pockets at low points. Pipe shall be extended to all gas equipment in building. All gas piping in return air plenums must be continuous or welded— no screwed fittings.
b. Valves or cocks and unions shall be installed on inlet pipe to all equipment, including safety valves where required or noted to be installed.
c. Pressure
2. Compressed Air Piping:
a. Drip pockets shall be provided at low points of piping for eliminating moisture.
b. Piping shall be connected near top of receiver with union and valve. Connections at equipment shall consist of a valve and union.
c. Install pipe tee at compressor, so that quick coupler may be added later to service condenser coil on air dryer.
3. Concealed Locations: Except as specified below, do not install concealed gas piping in an air-tight conduit constructed of Schedule 40, seamless black steel with welded joints. Vent conduit to the outside and terminate with a screened vent cap.
a. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to the approval of Owner), whether or not such spaces are used as a plenum. Valves shall not be located in such spaces.
b. Piping In Partitions: Concealed piping shall not be located in solid partitions. Tubing shall not be run inside hollow walls or partitions unless protected against physical damage. This does not apply to tubing passing through walls or partitions.

c. Prohibited Locations: Do not install gas piping in or through a circulating air duct, clothes chute, chimney or gas vent, ventilating duct, dumb waiter or elevator shaft. This does not apply to accessible above-ceiling space specified above.
d. Coordinate quick connect fitting sizes with Owner.

4. Drips and Sediment Traps: Install a drip leg with valve at points where condensate may collect, at the outlet of the gas meter, and in a location readily accessible to permit cleaning and emptying. Do not install drips where condensate is likely to freeze.
   a. Construct drips and sediment traps using a tee fitting with the bottom outlet plugged or capped. Use a minimum of three (3) pipe diameters in length for the drip leg. Use same size pipe for drip leg as the connected pipe.
5. Use fittings for all changes in direction and all branch connections.
6. Install gas piping at a uniform grade upward to risers, and from the risers to the meter, or service regulator when meter is not provided, or the equipment.
7. Connect branch outlet pipes from the top of horizontal lines, not from the bottom or sides.

B. Natural Gas Piping Specialties
   1. Protective Coating:
      a. Provide protective coating on piping and fittings that will be in contact with material or atmosphere exerting a corrosive action, or piping buried in floors. Protective coating shall be applied at the factory.

C. Valve Applications
   1. Shut-off Duty: Use gas cocks.

D. Valve Installations
   1. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.
   2. Install a gas cock both sides of each gas pressure regulator. Where two (2) gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.
   3. Install pressure relief devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position. Pipe atmospheric vent to outdoors.
   4. Valves shall be installed with unions or other means to facilitate removal or repair without disassembly of connecting piping.
   5. Gas Safety Valves:
      a. Install gas safety valves in wall boxes.
      b. Coordinate electrical requirements with Contractor. Provide neoprene grommets for all piping and electrical conduit entering and existing cabinets.

E. Terminal Equipment Connections
   1. Install gas cock upstream and within six (6) feet of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of controls.
   2. Sediment Traps: Install a tee fitting with the bottom outlet plugged or capped as close to the inlet of the gas appliance as practical. Drip leg shall be a minimum of three (3) pipe diameters in length. Provide valve above drip leg so gas service does not have to be shut down. The valve can be used to isolate the equipment being served.
   3. Flexible Hose Gas Connectors: For use connecting to vibrating equipment; corrugated Type 304 stainless steel flexible pipe with stainless steel braid.

END OF SECTION 22 11 23

22 13 16 – SANITARY WASTE AND VENT PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for sanitary waste and vent piping, including drains and drainage specialties. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Record Drawings.
- C. Maintenance Data.

1.04 QUALITY ASSURANCE
- A. Regulatory Requirements: Comply with the provisions of the following:
  1. PVC Pipe: Only Contractor's personnel which have received training in the installation of this material and meet the manufacturer's qualifications shall do the assembly of such material.
- B. Waterless Urinals: Copper piping shall not be used for waste and vent piping. Coordinate piping with Owner.

PART 2 – PRODUCTS

2.01 DRAINAGE PIPING SPECIALTIES
- A. Vandal-Proof Vent Caps: Vent cap must be compatible with the type of vent flashing installed.

2.02 CLEANOUTS
- A. Foor Cleanout: Cast iron body with recessed bronze closure plug; scoriated polished bronze frame and cover plate. No floor cleanouts on carpeted floors.
- B. Wall Cleanout tee with raised head brass plug tapped for one-quarter (¼) 20 thread; flat style chrome plated wall cover plate with holes for one-quarter (¼) inch bolt; one-quarter (¼) 20 threaded bolt with chrome plated flat head.

2.03 FLOOR DRAINS
- A. Toilet Rooms and Finished Areas:
  1. Six (6) inch round nickel bronze with adjustable strainer head.
- B. Boiler and Mechanical Rooms:
  1. Eight (8) inch round.

2.04 FLOOR SINKS
- A. Indirect Waste Drain – Kitchen Sinks:
  1. Square, sump body drain with removable half top grate.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Installation
  1. The installation of off-set closet flanges is prohibited.
  2. All floor drains are to be provided with P-trap the same size as the floor drain.

3. Provide waterproofing system for all floor drains in structure above slab on grade level. Provide waterproofing system for all floor drains, floor cleanouts, and shower drains above grade.
4. Provide full-size clean-outs in all restroom groups. Do not locate floor clean-outs in carpeted areas.
5. Cross-type drainage fittings shall not be installed in waste piping.
6. All restrooms to have floor drains.

B. Hangers and Supports: See specific section.

C. Installation of Piping Specialties
1. Install backwater valves in sanitary building drain piping. For interior installation, provide a minimum thirteen (13) inch diameter cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.
2. Above Ground Cleanouts:
   a. Easily accessible for maintenance.
   b. At each change in direction of piping greater than forty-five (45) degrees below slab.
   c. At minimum intervals of fifty (50) feet.
   d. At base of each vertical soil or waste stack at twelve (12) inches AFF.
   e. At sinks and urinals on grade.
   f. At each upper terminal.
   g. At egress of building (surface cleanout).
   h. At each water closet or toilet group.
3. Cleanout Covers: Install floor and wall cleanout covers for concealed piping, and in accessible locations.

D. Pipe and Tube Joint Construction
1. Install pipes and pipe joints in accordance with appropriate sections.

E. Installation of Floor Drains
1. Coordinate installation of floor drains with Owner.
2. Install floor drains at low points of surface areas to be drained. Set tops of drains flush with finished floor.
3. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain the integrity of waterproof membranes, where penetrated.
4. Position drains so that they are accessible and easy to maintain.

F. Waste, Vent, and Storm Piping
1. All waste, vent, and storm drain piping shall be properly pitched at one-quarter (¼) inch to the foot (or two percent (2%)) minimum for four (4) inches and smaller pipe and one-eighth (1/8) inch (or one percent (1%)) minimum for five (5) inches and larger. Piping shall be properly supported so that it will not sag and form pockets.
2. Locate vertical hubs of underground piping below partition walls for concealment. In locations where hubs will project beyond finish partition wall, set hubs one (1) inch below finished floor.
3. All waste, vent, and storm pipes underground outside of building shall be buried a minimum of three (3) feet, six (6) inches deep. Install tracer wire on all exterior utilities. Terminate in an approved termination box.
4. Where waste lines from fixtures are to be acid resistant, the vents shall also be acid resistant through roof.

G. Cleanouts
1. Full size brass cleanout plugs.

2. Wall cleanouts located four (4) inches to six (6) inches above floor with chrome-plated covers. Bottom of the cleanout cover shall be one (1) inch minimum above top of baseboard.
3. Provide at fifty (50) feet maximum intervals for all pipe sizes and wherever pipes change direction forty-five (45) degrees or more.
4. Scored brass cover for floor cleanout installed flush with the floor.
5. Outside of building starting ten (10) feet from perimeter wall:
    a. Locate every one hundred (100) feet.
    b. Heavy cast iron tractor cover set in two (2) feet by two (2) feet by six (6) inch concrete block.
    c. Four (4) inch size acceptable in pipes larger than four (4) inches.
6. Submit proposed locations of cover plates to Owner.
7. Do not install floor cleanouts in carpeted areas.
8. If a cleanout must be installed in a carpeted area, use a wall cleanout.

H. Service Connections
1. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

I. Connections
1. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap; but in no case smaller than required by the plumbing code.
2. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

J. Field Quality Control
1. Inspections:
    a. During the progress of the installation, notify the plumbing official having jurisdiction, at least forty-eight (48) hours prior to the time such inspection must be made.
        i. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after the system is roughed-in, and prior to setting fixtures.
        ii. Final Inspection: Arrange for a final inspection to observe the specified tests and to ensure compliance with the requirements of the plumbing code.
    b. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection.
    c. Reports: Prepare inspection reports signed by the plumbing official.
2. Post-Installation Inspection: The installing Contractor shall perform a visual inspection of all below-grade building drains using appropriate methods. Owner to be notified at time of inspection and have the option to be present.

END OF SECTION 22 13 16

22 13 23 – SANITARY WASTE INTERCEPTORS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for sanitary waste interceptors. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Record Drawings.
- D. Maintenance Data.

1.04 QUALITY ASSURANCE
- A. Manufacturers' Qualifications: Not less than five (5) years.

PART 2 – PRODUCTS

2.01 GREASE INTERCEPTORS
- A. No multi-piece grease traps shall be accepted. Grease traps must be one-piece vault with lid.
- B. Variations: Provide the following construction feature variations:
  1. Lift out sediment bucket.
  2. Enzyme opening.
- C. Unit shall be complete with internal baffle for secondary compartment of one-third (1/3) the total capacity, and concrete cover, with manholes.
- D. Install approved sill cock within twenty-five (25) feet of all grease traps.
- E. Manholes to Grease Trap:
  1. Manholes shall be constructed of pre-cast concrete rings manufactured to ASTM specifications and laid up in cement mortar.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 22 13 23

22 14 13 – FACILITY STORM DRAINAGE PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for storm drainage and vent piping systems, including drains and drainage specialties. Additional requirements may be included within specific agreements or other contracting documents.
- B. Requirements of this section pertain to the building. Requirements for piping outside of the building perimeter are to be coordinated with Owner.

1.03 SUBMITTALS REQUIRED
- A. Shop Drawings.
- B. Record Drawings.
- C. Maintenance Data.

PART 2 – PRODUCTS

2.01 PIPE AND FITTING
- A. Building Storm Sewer Below Grade: Cast iron bell & spigot with resilient gasket joints. Schedule 40 solid core PVC pipe and fittings. Purple Primer must be used. Foam core pipe will not be accepted. Cross Fitting will not be accepted.
- B. Storm and Roof Drains Above Grade: Cast iron no-hub, bell & spigot, or copper type DWV. No drain shall be less than two (2) inches nor any drain less than three (3) inches extended more than twenty (20) feet. Cross fittings are not to be used.

2.02 DRAINAGE PIPING SPECIALTIES
- A. See Section 22 13 16 – Sanitary Waste and Vent Piping.

2.03 ROOF DRAINS
- A. Roof Drain:
  1. Cast iron body with sump, removable cast iron vandal-proof dome strainer, cast iron flashing flange and cast-iron ring with integral gravel stop, underdeck clamp.
- B. Overflow Drain:
  1. Cast iron body with sump, removable cast iron vandal-proof dome strainer, cast iron flashing flange and cast-iron clamp with integral gravel stop, cast iron underdeck clamp.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Installation
  1. Install overflow roof drains with the inlet flow line located a maximum two (2) inches above the lowest point of roof.
- B. Installation of Roof Drains
  1. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.
  2. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain the integrity of waterproof membranes, where penetrated.

3. Position roof drains so that they are accessible and easy to maintain.

C. Building Storm Sewer
   1. Provide tracer wire on all exterior utilities, terminated tracer wire in an approved termination box.

D. Roof Drains
   1. Provide flexible connections to risers.
   2. Drain to storm sewer or on-site above grade drainage.
   3. Where internal overflow drains are required. Do not connect to the roof drain piping. Extend separate lines to the storm drain.
   4. Discharge roof drains into public storm sewers and not over sidewalks or at the tops of embankments, do not locate at exterior door locations. Locate effluent to preclude soil erosion.

END OF SECTION 22 14 13

22 16 00 – KITCHEN PIPING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for kitchen piping. Additional requirements may be included within specific agreements or other contracting documents.
- B. All kitchen piping and systems shall meet requirements of Larimer County Health Department.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Record Drawings.
- D. Maintenance Data.

PART 2 – PRODUCTS

2.01 PIPING
- A. No kitchen water lines are to be located in exterior walls.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 22 16 00

22 30 00 – PLUMBING EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for plumbing equipment.
   1. Sanitary drainage system.
   2. Storm drainage system.
   3. Domestic water system.
   4. Plumbing fixtures.
   5. Compressed air system.
   6. Natural gas system.

B. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 CONNECTIONS TO MISCELLANEOUS EQUIPMENT

2.02 SANITARY AND STORM SEWER SERVICE

A. Provide minimum three (3) feet, six (6) inches cover over sewer line(s) outside of building. Provide main cleanout where sewer(s) leaves building. All exterior utilities are to have tracer wire installed. Terminate in an approved termination box.

2.03 NATURAL GAS SERVICE

A. All underground gas service shall be approved piping; i.e., (P.E.) by gas with tracer wire.

2.04 WATER SERVICE

A. Job specific. All exterior utilities are to have tracer wire. Terminate in an approved termination box.

2.05 CLEANOUTS

A. Cleanouts shall be full line size through four (4) inch pipe.

B. Cleanout covers shall be "brass," square raised or recessed caps.

C. Inside caulk or spigot connections, bronze cleanout plug, straight threaded with tapered shoulder and caulked lead seat. Plugs shall be removed, doped, and reinstalled just tight enough to prevent leakage.

D. Screwed pipe cleanouts-bronze pipe threaded plug with four raised square lugs or counter sunk plug.

E. Floor Cleanouts (FCO): Frame and cover threaded for one and one-half (1½) inch vertical adjustment, threads protected with shield to be removed when concrete is set. Covers: Nickel bronze round frame and cover, deep flange tractor type. Extra heavy type in heavy traffic areas, and with carpet retainer top for carpeted floors. (Cleanouts will not be located in carpeted areas.)

F. Wall Cleanouts (WCO): Square nickel bronze frame and cover with minimum opening of six (6) inches by six (6) inch.

G. Grade Cleanouts (GCO): Cast iron cleanout with round, heavy-duty scoriated, non-tilt cast iron top, adjustable to finished grade level. Set GCO in two (2) feet by two (2) feet by four (4) inch deep concrete pad, minimum.
H. Cleanouts: Located at changes in direction of pipe run and shall consist of 'Y' fittings and eighth bends. Cleanouts shall be provided at the base of all vertical stacks with the cleanout plug located approximately twelve (12) inches AFF and extended to wall access cover. Cleanouts in horizontal runs above ground shall consist of 'Y' fittings with cleanout plugs. Cleanouts must be provided in every one hundred (100) feet of horizontal run, and as per the IPC. Cleanouts in carpeted floors should be avoided if at all possible. Use wall C.O.'s or C.O.'s in adjacent floors not carpeted.

2.06 FLOOR DRAINS

A. Provide floor drains of type specified herein. Sizes and locations shall be as indicated
B. Floor drains shall be cast iron with double drainage flange, nickel-bronze rim and strainer. Provide clamping ring when installed in floors that have waterproof membrane. Drains connected to cast iron soil pipe shall have spigot outlets.
C. Trap seal shall be used on all floor drains and floor sinks.
D. Floor drains in slabs on ground
    1. Floor Drains shall be Z-415 with a six (6) inch diameter Type 'B' strainer and Z1000 cast iron deep seal P-trap.
E. Floor, shower, and area drains in slabs above ground.
    1. Floor drains shall be Z-415 with a six (6) inch diameter Type 'B' strainer and Z1000 cast iron deep seal 'P' trap. All exposed parts to be nickel bronze. Clamping ring will be required for floor drains in mechanical equipment room(s). Strainers for drains in the equipment room may be brass in lieu of nickel-bronze.

2.07 FLOOR SINK

A. Floor sink shall be epoxy or porcelain coated cast iron, acid resisting, twelve (12) inches by twelve (12) inches, acid resisting anti-splash dome strainer, Foot Traffic rated grate. (acid resisting), eight (8) inches deep, three (3) inches inside caulk bottom outlet, wrapped with water resistant wall covering six (6) inches above faucets; i.e., tile or equivalent; Zurn Z-1901 or equivalent.

2.08 ROOF DRAINS

A. No plastic domes shall be accepted. Domes must be bolted down. Tar is unacceptable. With no-hub bottom outlet.
B. Roof drains shall be cast iron, combination clamping ring and gravel guard, under deck clamp, aluminum or cast-iron dome enclosing entire drain sump, insulation extension sleeve of the same thickness as insulation. Where the metal deck is used, provide a steel roof sump formed to receive roof drain without any raise in insulation at roof drain.
    1. RD-1: 21500-3-10.
    2. ORD01: Same as above, except provide option 16 three (3) inch internal waterguard (standpipe) for drains used as overflow drains.
C. Provide forty-two (42) inch by forty-two (42) inch four (4) pounds per square foot lead pan or sixteen (16) ounce cold rolled copper flashing flanges for each drain.
D. Downspout nozzles shall be all bronze construction with threaded inlet and wall flange. Nozzles shall be similar to Josam 25010. Do not place downspouts where they could drain to exterior walking path.

2.09 VENTS THROUGH ROOF

A. Flash vents through roof with twenty-four (24) inches by twenty-four (24) inches by four (4) pound minimum size sheet lead. Extend lead five (5) inches above the vent and turn down into

vent pipe. Do not install vents within two (2) feet of roof edge, parapet or wall line of an "on-the-roof structure."

B. All plumbing vents through the roof shall terminate with cast iron vandal proof vent caps. Vent caps shall be similar to Wade W-3680, or equal by Josam, Smith, or Zurn.

2.10 SHOCK ABSORBERS

A. Shock absorbers shall be furnished and installed at all solenoids and other quick closing valves and flush valves. Provide and install access doors for all shock absorbers. Each shock absorber shall have a shut-off ball valve for replacement.

2.11 BACKFLOW PREVENTER

A. Shall be the reduced pressure type with atmospheric vent.
B. Bronze body and accessory construction and replaceable seats.
C. Bronze body ball valve test cocks and one-quarter (¼) turn ball valves on inlet and outlet.
D. With bronze strainer, flanged adapter ends or unions, and air gap fitting.

2.12 PRESSURE REDUCING VALVE

A. Where main pressure exceeds eighty (80) psi, provide, a domestic water pressure reducing valve as manufactured by Watts, Fisher, or approved equal. Provide isolation valves and unions on both sides of all PRVs.
B. Valve shall be of bronze body construction with renewable stainless steel seat, adjustable outlet pressure, and suitable for inlet pressures up to one hundred-fifty (150) psig. Valve shall be initially set for sixty (60) psig discharge pressure.
C. Install main shut-off valve not more than five (5) feet AFF.
D. Backfill:
    1. Backfill within two (2) feet of manhole shall be free from rocks and lumps. Dispose of excavated material promptly.

2.13 EMERGENCY GAS SHUT-OFF

A. Provide a control panel near

2.14 THERMOSTATIC MIXING VALVE

A. Mixing valve shall be capable of instant compensation for fluctuations in supply pressure and/or temperature of either supply to provide constant mixed water temperature at variable flow rates.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 22 30 00

22 31 00 – WATER TREATMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for water equipment.
  1. Cleaning of piping systems.
  2. Sterilization of domestic water system.
- B. Additional requirements may be included within specific agreements or other contracting documents.
- C. Provide service program, including chemicals if applicable, for a period of one year from start-up date of equipment, including the following:
  1. Initial water analysis and recommendations.
  2. Systems start-up assistance.
  3. Training of operating personnel.
  4. Periodic field service and consultation.
  5. Customer report charts and log sheets.
  6. Laboratory technical assistance.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Record Drawings.
- C. Maintenance Data.

1.04 QUALITY ASSURANCCE
- A. Manufacturers and Representative Qualifications: Not less than five (5) years, and shall have full-time service personnel located within the trading area of job site.

1.05 REGULATORY REQUIREMENTS
- A. Extended Maintenance Services
  1. Agreement to Maintain: Prior to time of final acceptance, submit four (4) copies of "Agreement for continued Service and Maintenance" for water treatment system, for Owner's possible acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing, and including replacement of materials and equipment, for one (1) year period with option for renewal of Agreement by Owner.

PART 2 – PRODUCTS

2.01 PRODUCTS
- A. Consider systems that avoid use of chemical systems to achieve the water quality parameters.

PART 3 – EXECUTION

3.01 CLEANING AND PROTECTION
- A. Cleaning of Pipelines and Boilers
  1. All cleaning and flushing of hydronic systems shall be witnessed by an Owner’s Representative. Provide minimum twenty-four (24) hours’ notice prior to performing work.

2. The Water Treatment Contractor shall be responsible for furnishing the cleaning material and supervising the cleaning of the chilled and/or heating piping.
3. The system to be cleaned shall be filled with a solution of ten percent (10%) by weight of a heavy duty alkaline liquid cleaner. The cleaner shall be capable of wetting and penetrating heavy soil deposits of oil or grease, and keeping these products in suspension, for removal through flushing the system to drain.
4. The cleaning solution shall be circulated for a minimum of eight (8) hours. At the end of the eight hours, the system shall be flushed to drain, and then refilled with fresh water, taking care to remove any entrapped air from the system.
5. At the end of the cleaning period, the system shall be chemically treated as specified. In no case shall the system being cleaned be left in an untreated condition for more than eight (8) hours.
6. At the conclusion of the cleaning operation, the Water Treatment Contractor shall certify in writing that the system was cleaned as specified.

B. Chlorination
1. Acceptable products are:
   a. Liquid Chlorine Fed. Spec. BB-C120B Hypochlorite Fed. Spec 0-C-114, Type 11, Grade B Fed. Spec. 0-S-60D, Grade A or B.
2. After all pressure tests have been performed and piping has been flushed clean, the chemical treatment contractor shall be responsible for sterilizing the domestic water lines.
3. Chlorination procedures shall comply with local code and health department regulations.
   a. Before commencing the chlorination process, the Water Treatment Contractor shall post signs at each water fountain, and on each restroom door, stating that the water is not fit for drinking, and that the water is being chlorinated.
   b. Introduce sufficient chlorine into the domestic water system to provide a dosage of not less than fifty (50) parts per million at each faucet and valve. The chlorine solution shall then be allowed to stand for a minimum of twenty-four (24) hours in the system.
   c. At the end of twenty-four (24) hours test shall be made for residual chlorine at the extreme end of the system from the point where chlorine was introduced. If chlorine residual is less than ten (10) ppm, the chlorination procedure shall be repeated.
   d. Flush the system with a clean supply of water until the chlorine residual in the system is reduced to less than one (1) ppm, or to the chlorine residual of the supply water. During the flushing, each faucet and valve in the system shall be opened and closed a minimum of four (4) times.
   e. After twenty-four (24) hours, the water treatment representative will have samples taken and tested by an independent laboratory. The system must be free of bacteriological contamination. If the system is contaminated, it shall be re-chlorinated until a satisfactory test is made.
   f. The Water Treatment Contractor shall write a letter, informing the Mechanical Contractor that the building has been successfully chlorinated, and that the water is fit for human consumption.

C. Testing
1. Closed Systems:
   a. Provide a Nitrite "Drop Test" kit for determining the level of Nitrite or Molybdate in the closed system.

D. System Start-Up
1. The Water Treatment Supplier shall put the system into operation, and make adjustments necessary for proper operation.

2. The Water Treatment Supplier shall provide a written report indicating that the start-up has been completed and that all Water Treatment Equipment is operating properly.

E. Testing and Cleaning
   1. Sample all treated water systems at one-week intervals after start-up for period of four (4) weeks and prepare certified test report for each system being treated.
   2. Start-up test and adjust water conditioners in presence of manufacturer's authorized representative. Operate units including regeneration, back washing, rinsing and flushing. Adjust unit to maintain required steady state effluent water quality.
   3. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

F. Closeout Procedures
   1. Provide services of manufacturer's technical representative for one eight (8) hour day to instruct Owner's personnel in operation and maintenance of water treatment systems.

END OF SECTION 22 31 00

22 33 00 – DOMESTIC WATER HEATERS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for domestic water heaters. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Wiring Diagrams.
- D. Record Drawings.
- E. Maintenance Data.
- F. Certificates.

1.04 QUALITY ASSURANCE
- A. Manufacturer’s Qualifications: Not less than five (5) years.
- B. Special Project Warranty
  1. Warranty on Heat Exchanger, and Burner: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, heat exchangers, and burners with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
     a. Warranty Period: Ten (10) years from Date of Substantial Completion for the pressure vessel five (5) years from date of Substantial Completion for the heat exchanger.

PART 2 – PRODUCTS

2.01 COMMERCIAL GAS-FIRED WATER HEATERS
- A. Provide certification of design by AGA under Volume III tests for commercial water heaters for delivery of one hundred-eighty (180) degrees Fahrenheit (eighty-two (82) degrees Celsius) water.
- B. Water heater shall be of gas fired, condensing fire tube design with a modulating power burner and positive pressure discharge. Burner shall be capable of fourteen to one (14:1) turndown of firing rate without loss of combustion efficiency. Heat exchanger/combustion chamber shall incorporate a helical fire tube design that will be self-supporting, baffle free, and warranted to withstand thermal shock. Heat exchanger shall be copper lined and ASME stamped for a working pressure not less than one hundred-fifty (150) psig. Unit shall have an ASME approved temperature/pressure relief valve with a setting of one hundred-fifty (150) psig. Exhaust manifold shall be of corrosion resistant porcelain enameled cast iron, with a six (6) inch diameter flue connection. Exhaust manifold shall have a gravity drain for the elimination of condensation with collecting reservoir.

C. The flame monitoring system shall incorporate a UL recognized combustion safeguard system utilizing interrupted spark ignition and a rectification type flame sensor. An electro-hydraulic double seated safety shall be an inherent part of the gas train.
D. Water heater shall incorporate electric probe type low water cutoff and dual over temperature protection including a manual reset in accordance with ASME and CSD-1. Remote fault alarm contacts and sensor failure detection shall be standard equipment. Heater shall operate on 120/1/60.
E. Water Heater shall include integral factory wired operating controls to control all operation and energy input. Control of discharge water temperature shall be set through an internal setpoint with a field adjustment of one hundred (100) degrees to two hundred (200) degrees Fahrenheit. Units shall maintain discharge temperature within specified range through domestic water flow variations from zero (0) to one hundred percent (100%).
F. Heater shall be capable of maintaining the outlet temperature within an accuracy of four (4) degrees Fahrenheit. This shall be accomplished by modulation of firing rate from one hundred (100%) to seven percent (7%) of rated input. Units shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input.
G. Accessories: Provide brass drain valve; three-quarters (¾) inch pressure and temperature relief valve; and radiant floor shield.
H. Controls: Provide gas pressure regulator; pilot gas regulator; thermostat; and temperature limit control.

2.02 GAS-FIRED WATER HEATER AND STORAGE TANK

A. Gas water heater to be Bradford White EF series minimum thermal efficiency of ninety-two percent (92%) provide separate storage tank and pumping system as needed.
B. Provide check valve on DCW to DHW boiler systems to prevent backflow. (See Valve spec)
C. Centralize H2O heating with HWC.
D. Tank shall be a separate vertical glass-lined tank, with heavy gauge steel jacket with baked enamel finish. R-16 foam insulation. Cathodic protection. Provide T/P rated relief valve, mercury industrial type thermometer and other accessories and connections as recommended by the manufacturer and/or as detailed.
E. Make taps accessible with union on drain outlet.
F. Units shall be as manufactured by Bradford White, one hundred-ninety-nine thousand (199,000) Btuh input, and one hundred-eighty-one (181) gph recovery at one hundred (100) degree temperature rise at sea level. Model TJV-120A tank, one hundred- nineteen (119) gallon storage each.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of Water Heaters
    1. Supports: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.
    2. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closest floor drain.
    3. Gauges: Provide thermometers on inlet and outlet piping of water heaters, in accordance with Basic Mechanical Materials and Methods Section "Meters and Gauges."

4. Gas-Fired Water Heaters: Connect gas supply to gas line with drip leg, tee, gas cock, and union; full size of unit inlet connection. Locate piping so as not to interfere with service of unit.
    a. Flue: Connect flue to draft hood with gas-tight connection. Provide flue of minimum size as flue outlet on heater. Comply with gas utility requirements.

B. Field Quality Control
1. Start-Up: Start-up, test, and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and utility company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.

C. Closeout Procedures
1. Training: Provide services of manufacturer's technical representative for one (1) half day to instruct Owner's personnel in operation and maintenance of water heaters.
    a. Schedule training with Owner, provide at least seven (7) day notice to Contractor and Engineer of training date.

END OF SECTION 22 33 00

22 40 00 PLUMBING FIXTURES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for plumbing fixtures. Additional requirements may be included within specific agreements or other contracting documents.
B. Where there is a conflict between the IPC and the IBC, the latter prevails.
C. Locate a shut-off ball valve on the water main at the point where it enters the building. Clearly label it as the water main shut off.
D. Provide a pressure-reducing valve, if required, on the water main just downstream of the main shut off ball valve to limit the pressure in the building to eighty (80) psig.
E. The potable water supply system including specialties, valves, pipe and fixtures shall meet the current Primary Drinking Water Regulations published by the Colorado Department of Health.
F. Water Service Sizing: Given the enormous difference in the cost of fees for upsizing water tap and meter, careful consideration must be given to both plumbing and irrigation design and sizing.
G. Sink/Drinking Fountain Combination:
    1. May be used outside toilet rooms provided the toilet rooms have separate hand washing sinks.
H. No wrist blade handles.
I. No column showers.
J. No eight (8) inch spread Lav Faucets.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Floor and Area Drains
    1. Cast iron with a double drainage flange.
B. Roof drains
    1. Cast iron body with removable cast iron or aluminum dome strainer (no plastic).
C. Toilets
    1. Sloan fixtures will not be accepted.
    2. Tank Toilet for ADA: Kohler Cimarron K-3609 is the preferred model. Floor mounted, 16.5-inch bowl AFF. Elongated, white vitreous china, 1.28 GPF, Church 255 Plastic open front seat, chrome stop and supply.
    3. American Standard 2257.528 (or approved equivalent) Top Spud bowl with battery powered sensor flush valve. Wall mounted, elongated, white vitreous china, mount at std. height, 1.28 GPF, Min one thousand (1000) gram map rating. Church 255 Plastic open front seat, Zurn Z1203N wall mount adjustable no-hub carrier.
D. Urinals
    1. To be waterless models as specified by the Owner.
E. Lavatories
    1. Verify all fixtures with Owner prior to procurement.

2. Lavatory ADA: American Standard 0476.028 Aqualyn, 20.3-inch by 17.3-inch o.d., sixteen (16) inch by ten (10) inch by 5.6-inch-deep bowl, oval, countertop, self-rimming, white vitreous china. Verify holes for faucet with owner - American Standard 6055.205 Battery powered sensor faucet, (0.5 GPM), with grid strainer, 1.5-inch PVC P-Trap, chrome stops and supplies. Truebro 402W plastic insulation package for ADA protection with TMV-1.
3. Lavatory ADA: American Standard 0355.012 Lucerne, wall mount 20.5-inch by 18.25-inch o.d. fifteen (15) inch by ten (10) inch by 6.5-inch-deep bowl, ADA with rim mounted at thirty-four (34) inches AFF white vitreous china, Zurn 1231 wall hanger-American Standard 6055.205 battery powered sensor faucet, (0.5 GPM), Verify holes for faucet with owner, with grid strainer, 1.5-inch PVC P-trap, chrome stops and supplies. Truebro 402W plastic insulation package for ADA protection with TMV-1.
4. Sink: Elkay GECR3321, celebrity double compartment, thirty-three (33) inch by 21.25-inch o.d. twenty (20) gauge, 304 stainless steel, countertop, self-rimming, verify holes for faucet with owner, Delta 400-DST faucet, single handle nine (9) inch swing spout, chrome finish vegetable spray, one and one-half (1½) inch PVC P-trap, chrome stops and supplies, ISE Badger 5 disposal, one-half (½) HP, 120/240 Volt.
5. Provide recirculating hot water pumps at all new sinks and lavatories (within eighteen (18) inches). See Section 23 50 00 section I-3 Hot Water Heat Pump and Recirculating pumps for details.

F. Electric Water Cooler
1. Elkay Bottle Filling Station with Single ADA cooler or accepted equivalent #EMABF8WSLK 9.6 GPH each at seventy (70) degrees Fahrenheit room temperature, fifty (50) degrees Fahrenheit supply water temperature, right and left side closing push buttons, galvanized frame, stainless steel basin, gray shroud, 1.5-inch P-Traps, chrome stops and supplies, three hundred-seventy (370) watts, one hundred-twenty (120) volts, five (5) year warranty, Zurn Z1225 wall carrier.

2.02 PRODUCTS

A. Cleanouts of cast iron only.
B. Grease, solids, or oil interceptors:
1. Concrete only.
2. Conform to UPC Chapter 7.
3. Submit sizing calculations to the applicable water and sewer district.
C. Provide one key operated switch and a natural gas normally closed solenoid valve in each lab that uses gas. Mount the key switch on a double gang box with a red pilot light to indicate that the valve is energized and open. Pipe the solenoid to shut off all gas to the lab gas jets. Valve, switch and pilot, one hundred-twenty (120) VAC. Valve UL listed. The key must be removable in either the on or the off position.
D. Provide properly sized neutralization vessels for chemistry labs.
E. Backflow Preventers: Watts 909QTU only.
F. Shock Absorbers: Water hammer arresters placed in appropriate locations near fixtures that have quick shut off.
G. Plumbing Fixture Types
1. The exposed flush, waste, and supply pipes at the fixtures shall be chromium plated brass pipe, iron pipe size. Fittings and traps for brass pipe shall be cast brass, chromium plated.
2. Install chromium-plated brass wall or floor plates with setscrew where piping passes through walls or floors.
3. Chromium-plated brass, same shall mean polished brass, first nickel plated and finished with chromium plate.

4. All lavatories and sinks shall be furnished with three-eighth (3/8) inch S.P.S. flexible tube supply pipes, key stops and escutcheons, Tempered water shall be provided at all hand washing sinks and classroom sinks. Per ASSE1070 or CSA B125.3.
5. All lavatories and sinks shall be furnished with one and one-half (1½) inch tailpiece, cast brass chrome plated one and one-quarter (1¼) inch traps and tailpieces for lavatories and one and one-half (1½) inch traps and tailpieces for sinks with cleanout one and one-half (1½) inch, seventeen (17) gauge tubing waste to wall and wall escutcheons.
6. All fixtures fitted to the walls or floor shall be ground square and true and be sealed with mildew resistant non-hardening clear or white silicon bead, with Architect/Engineer's approval.
7. The following schedule establishes the standards to which each type of fixture must conform, and the plumbing fixture portfolios shall completely illustrate and describe each type.
8. Wall hung fixtures from concrete block shall be supported by wall hangers and fixtures hung from stud partition walls shall have internal wall carriers (submit shop drawings for review)
9. No off-set flanges shall be used for water closets. Shim with sheet lead if required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Terminate vents with a vandal proof cast iron cap that prevents the insertion of obstructive objects. Install a check valve in each gas jet in labs to prevent water being injected into the gas line.
B. Make no connection from the potable water lines to any service that contains ethylene glycol antifreeze or water treatment chemicals even if that connection is protected by a backflow preventer.
C. Ethylene glycol is only allowed in chilled water systems and must be protected by an approved pressure reduced Backflow Preventer.

END OF SECTION 22 40 00

22 70 00 – PUMPS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for pumps.
  1. For water or water/glycol pumping services.
  2. The Consultant shall specify and include in the Equipment Schedule two (2) operating points for any pump that may operate under more than one condition; i.e., one (1) pump or two (2) pumps running.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS
- A. Two (2) copies for each pump service offered.
- B. Certified dimensional drawings including locations, sizes and types of each piping connection, baseplate mounting details and electrical connections.
- C. Installation, maintenance, disassembly, operating and parts-list manuals.
- D. Recommended spare parts list.
- E. Characteristic design curve.
- F. Standard manufacturer's catalog data.

1.04 REGULATORY REQUIREMENTS
- A. HI.
- B. NEC.
- C. NEMA.

PART 2 – PRODUCTS

2.01 GENERAL
- A. Use cartridge pumps whenever possible.

2.02 SINGLE ASSEMBLY FRAME-MOUNTED ON A COMMON BASEPLATE
- A. Pump.
- B. Electric drive motor.
- C. Shaft coupling and guard.
- D. Baseplate.
- E. Pressure gauges and pressure/temperature taps.

2.03 SERVICE
- A. Performance specified by the Engineer.
- B. Vibration shall be such that the value of self-excited vibration velocity is less than 0.10-inch per second when measured with a vibration meter on the frame or bearings of the pump assembly in any of the three (3) axes. The pump and motor assemblies shall be both statically and dynamically balanced so as not to exceed the vibration limits.
- C. All motors to be “Premium Efficiency.”
- D. The nameplate horsepower rating without consideration of the service factor, shall not be exceeded at any point along the performance curve of any pump at its rated rpm.

2.04 CONSTRUCTION DETAILS FOR PUMPS LARHER THAN ½ HP

A. Horizontal centrifugal end suction or split case, cast iron bronze fitted.
B. Constantly rising characteristic curve from design point to minimum flow.
C. Bronze impeller.
D. Regreasable ball bearings.
E. John Crane mechanical seals with carbon seal rings and ceramic seats.
F. Non-ferrous metal nameplate with manufacturer's name, model number, GPM, head, impeller diameter and RPM.
G. Suction Diffusers to be used on base mounted pumps.

2.05 BRONZE FITTED IN-LINE CENTRIFUGAL PUMPS OF ½ HP OR LESS

A. May be used as circulators or boosters in heating, hot potable or other closed loop water systems. In-line pumps larger than one-half (½) HP are strongly discouraged. If space limitations do not permit base mounted pumps, the choice of in-line pumps will be decided jointly by the Architect/Engineer and the Owner.

2.06 HOT WATER HEATING PUMP AND DOMESTIC HOT WATER CIRC PUMPS

A. Pumps shall be of type and have characteristics as scheduled and shall be as specified herein. Pumps shall have mechanical seals designed for hot water service to two hundred-two (220) degrees Fahrenheit, steel shafts, renewable wearing rings, bronze impellers, and casings designed for one hundred-fifty (150) psig working pressure. Pumps, except close-coupled type, shall have flexible couplings of nonmetallic or single barrel spring design. Multiple spring couplers will not be accepted.
B. Pump manufacturer shall machine the pump impellers, if necessary, to meet capacities scheduled. Pumps shall be dynamically balanced prior to shipment.
C. Sump pump discharge above ground:
    1. Piping shall be type "L" hard drawn copper water tube with directional fittings wrought copper solder joint. Valves to be rated for appropriate temperature.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Place unions or flanges between the pump and the isolation valves on the suction and discharge lines so that the pump may be removed for service without cutting the piping. Provide for temporary "by-pass" when pump is removed.
B. Include pressure gauges and P/T taps in the suction and discharge lines in locations that will provide a reasonably accurate check of pump performance, and on both sides of the strainer.
C. Field level and alignment:
    1. Level and align pumps and motors on bases and foundation pads in accordance with the manufacturer’s instructions and within their recommended tolerances using and indicating micrometer. Do this prior to connecting any piping or electrical to pump.
    2. Recheck levels and alignment after piping and electrical connections are made and prior to placing each pump in operation. Make adjustments to assure that the thrust is balanced, that the shaft rotates freely when turned by hand, and that the pump is quiet.
    3. Verify alignment and vibration with Owner.
    4. When adjustments are complete, tighten bolts and grout pump and motor. Lubricate pumps in accordance with manufacturer’s recommendations after completion of system installation and prior to startup.

END OF SECTION 22 70 00

22 80 00 – IRRIGATION INSTALLATION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for irrigation installation. Additional requirements may be included within specific agreements or other contracting documents.

B. This section to be maintained by the Parks Division. All irrigation systems installed on City projects will match the specs set by the parks department.

1.03 PROCEDURES AND REQUIREMENTS

A. An Irrigation Designer, certified by the Irrigation Association, shall do irrigation design or someone approved by the City of Fort Collins Parks Division.

B. Irrigation system design and installation shall be monitored, inspected, and approved by the Owner. Taps should be sized so the park can be irrigated in eight (8) to ten (10) hours minimizing impact on users. Irrigation taps should be separate from the restroom tap so that sewer charges are not incurred on irrigation water. Irrigation systems shall be installed and maintained so that no heads spray onto any streets in such a way that they spray passing motorists or pedestrians. Heads should be adjusted wherever possible so that they do not overspray street side sidewalks.

C. The irrigation system must comply with the Uniform Plumbing Code and with the City of Fort Collins Electrical Code.

D. Any deviation in taps from the approved construction plans must be approved by the City Water/Wastewater Division prior to installation. Any water service line shall be coordinated with City of Fort Collins Water Utility. Any deviation in layout of the irrigation system from the approved construction plans must be reviewed and approved by the City Parks Division prior to installation. Taps from Fort Collins-Loveland Water District must have a private isolation valve downstream of the meter for maintenance and winterization.

E. The irrigation system must be designed to provide full coverage and matched precipitation rates. Systems on raw water should be designed so that they can run at pressures and volumes determined by the backup domestic tap size. Main line piping shall be sized based on flow demands (gpm's); velocities shall not exceed 5.0 feet/second. Lateral piping shall be sized based on flow demands (gpm's). Velocities shall not exceed 6.5 feet/second. Principles of Xeriscape shall be utilized in the design of the irrigation system. The distribution uniformities for spray heads should be .55, rotor heads should be .65, stream rotors should be .75 and impact heads should be .65. An irrigation audit should be conducted by a certified irrigation auditor to confirm the targets have been met. Some design considerations include: shrub and perennial beds are to be zoned separately from turf areas; limited irrigation on medians in parking lots; consider separate bubbler zones for trees in drought situations, no valves on any sports fields; ballfield hose hookups with one and one-half (1½) inch swing joints for ballfield on both sidelines; all part circles heads should be rotors, full circles can be either impacts or rotors; pop-up zones should use pressure regulating heads instead of pressure regulating valves, sloped areas are to have separate zoning for heads at the higher elevations from those at the lower elevation and areas with different exposures are to be zoned separately. Zones on ballfields should be independent

to allow watering for seed or sod just to affect one field. Check valve-in-head should be used when head has that option to save water. Check valves-in-head are to be used for all areas adjacent to walkways and at the bottom of berms and pond areas. The blowout fitting for winterization downstream of the backflow should be one and one-half (1½) inches for mainlines three (3) inches or larger and one (1) inch for mainlines two and one-half (2½) inches and smaller.

PART 2 – PRODUCTS

2.01 MAINLINE

A. Class 200 PVC, NSF approved.
   1. If Three (3) Inches or Larger: Ringtite pipe.
   2. If Two and One-Half (2½) Inches or Smaller: Glue joint.

2.02 LATERALS

A. Two (2) Inches or Larger: Class 200 PVC, NSF approved.
B. One and One-half (1½) Inches or One (1) Inch: Class 200 PVC, NSF approved.
C. No laterals smaller than one (1) inch are permitted.
D. Trickle tubing shall be weather and UV resistant material.
E. Polyethylene Drip Pipe: NSF approved, SDR pressure rated pipe, only as approved for drip applications.

2.03 PIPE FITTINGS

A. Funny Pipe (pop-up turf heads only): to be compatible to the elbows needed for the sprinkler heads. The maximum length of funny pipe allowed is three (3) feet.
B. Lateral Fittings: Schedule 40, Type 1, PVC solvent weld with ASTM Standards D2466 and D1784.
C. Wrought copper or cast bronze fittings, soldered or threaded per installation details for all copper pipes.
D. Mainline Fittings: Ductile iron for three (3) inches and larger, PVC Schedule 80 for two and one-half (2½) inches and smaller.
E. No prefabricated swing joints.

2.04 SLEEVES

A. Ductile Iron Pipe or PVC under all paved surfaces.
   1. Sizes to be a minimum of two (2) sizes larger than the pipe being sleeved. Minimum two (2) inch diameter or larger for irrigation lines. Use full sections of pipe to minimize the number of joints under pavement.
   2. Wires to be in separate sleeve from pipe, two (2) inch minimum size pipe for control wire sleeves.
   3. Sleeves shall have marker tape on upper side and both ends for future locates.

2.05 VALVES

A. Remote Control Zone Valves: Electrically operated, appropriate for the water supply, with manual bleed device and flow control stem. It shall have a slow-opening and slowclosing action for protection against surge pressure. On pop-up zones, use pressure regulating pop-up spray heads instead of pressure regulating valves. If the valve is two (2) inches or larger it should have a brass body. If the valve is one and one-half (1½) inches or smaller it can be either brass or plastic. Valve brand to be approved by the Parks Department.
B. Isolation Gate Valves: Able to withstand a continuous operating pressure of one hundred-fifty (150) psi. Clear waterway equal to full diameter of pipe. Shall be opened by turning two (2) inch square nut to the left (wheel opening is unacceptable).
C. Manual Drain Valve: Three-quarters (¾) inch ball valve with tee handle.
D. Quick Coupling Valves: One (1) inch brass with rubber cover.

2.06 VALVE BOXES

A. House valves in valve box with matching locking cover. Only one (1) valve per box. Install in box sizes to allow work on components.

2.07 CONTROL SYSTEM

A. Controller: Irritrol MC Series controller 18 Stations or equal to be approved by the Parks Department. The controller shall be remote ready and use ADAPT-1 cable. Each controller shall have a separate Eicon MRX-RR receiver. One Eicon TRX-5V will be provided by the contractor for project. Frequency to be determined by Parks Department. Controller box shall be weather tight and vandal resistant, with locking exterior disconnect.

B. Systems with Central Irrigation controls. If park is near a central control park and can be controlled by that system, it should be considered. If the park is a domestic water

C. source, it will need a master valve/flow meter. It shall be Arad or approved equal by Parks Dept.

D. Control System Enclosure: If the park has a pump house, install in pump house on same wall as the door. If there is no pump house, install in a Strong Box or equal to be approved by the Parks Department.

E. Surge Protection: Eight (8) foot copper grounding rod, double ott stranded copper wire, exothermic connection to ground rod, grounding buss receptacle, ground terminal strip and Irritrol SPD-587 surge protector per details.

F. Install Mini-Clik II or wireless rain sensor, manufacturer to be approved by the Parks Department (one per controller) at location near the controller but not where it will receive precipitation from the irrigation system or easily vandalized. Owner must approve location.

G. Run valve wires to junction box in the pump house. Label wires with the identification number of the remote control valve activated by the wire. Install terminal strips and run 18-gauge wire from junction box terminal strips to controller. Wire shall be in conduit.

2.08 ELECTRIC CONTROL WIRING

A. #14 solid copper direct burial UF or PE cable, UL approved, or larger, per system design and manufacturer's recommendations.
   1. Five wire colors with consistent color scheme throughout:
      a. Red = Live (one per valve).
      b. White = Ground (#12 solid copper direct burial Cable).
      c. Black, Blue and Green = Extra.
   2. Wire connections should be made with dry splices rated for underground installation to join control wires to remote control valves.
   3. Wire splices need to be in a valve box not less than every two thousand-five hundred (2500) feet not counting remote control valve boxes.

B. Two wire systems should be considered when practical.

2.09 SPRINKLER HEADS

A. All heads shall be of the same manufacturer as specified on the plans, and marked with the manufacturer's name and model in such a way that materials can be identified without removal from the system. City will specify brand and models to match other equipment in use in public system in the vicinity.
   1. Gear Driven Rotor Heads: Hunter, Rainbird, or approved equal.
   2. Impact Heads: Rainbird or approved equal.
   3. Pop-Up Spray Heads: Rainbird 1800 PRS SAM, or approved equal.

B. BACKFLOW PREVENTERS
   1. Backflow preventer shall be Febco brand and shall be installed and tested in compliance with the Colorado Primary Drinking Water Regulations.

PART 3 – EXECUTION

3.01 INSPECTION

A. Locate all utilities prior to trenching and protect from damage. Required calls shall include, but are not limited to the following: Call 221-6660 for Parks Division locates. Call 1-800-922-1987 for Utility Locates in the City of Fort Collins. Contact other Utilities as required. Inspect tap or other existing irrigation system, as applicable, prior to work.

3.02 EXECUTION

A. Pipe Trenching:
   1. Install pipe in open cut trenches of sufficient width to facilitate thorough tamping/puddling of suitable backfill material under and over pipe.
   2. Trench Depths:
      a. Mainline: Minimum of twenty-four (24) inches deep from top of pipe to finished grade.
      b. Lateral: Minimum of sixteen (16) inches deep from top of pipe to finished grade.
      c. Sleeves: Install sleeves at a depth, which permits the encased pipe or wiring to remain at the specified burial depth.

B. Sleeves:
   1. Boring shall not be permitted unless obstruction in pipe path cannot be moved, or pipe cannot be re-routed.
      a. Mainline installed in existing sleeves at greater depth than adjacent pipe, shall have a manual drain valve at each end if the sleeve is longer than twenty (20) feet, or at one end if the sleeve is less than twenty (20) feet.
      b. Install sleeve so ends extend past edge of curb, gutter, sidewalk, bike path or other obstruction, a minimum of two (2) feet.
      c. Mark all sleeves with an "x" chiseled in walk (or other surface) directly over sleeve location.
      d. Sleeves installed for future use shall be capped at both ends.
      e. Separate sleeve (two (2) inch minimum size) shall be used for all wiring.
      f. Sleeves shall not have joints. If joints are necessary, only solvent welded joints are allowed.
      g. Compaction of backfill for sleeves shall be ninety-five percent (95%) of Standard Proctor Density, ASTM D698-78. Use of water (puddling) around sleeves for compaction will not be allowed.
      h. Laterals along property lines shall be installed two (2) to three (3) feet inside of property line and teed over for heads. This avoids problems with homeowners installing fences at later dates.

3.03 INSTALLATION

A. Pipe Installation:
   1. Use Teflon tape on all threaded joints; only Schedule 80 pipe may be threaded.
   2. Reducing pipe size shall be with insert reducing bushing at the tee.
   3. Snake PVC lateral pipe from side to side within trench.
   4. Cut pipe ends square and de-burr. Clean pipe ends before using primer and solvent cement. Join in manner recommended by manufacturer and in accordance with accepted industry practices. Cure for thirty (30) minutes before handling and twenty-four (24) hours before allowing water in pipe.
   5. Backfill shall be free from rubbish, stones larger than two (2) inch diameter, frozen material and vegetative matter. Do not backfill in freezing weather. If backfill material is rocky, the pipe shall be bedded in two (2) inches of fill sand covered by six (6) inches of fill sand.

6. After puddling or tamping, leave all trenches slightly mounded to allow for settling.
7. Compact to proper densities depending on whether surface area over the line will be paved or landscaped.

B. Thrust Blocks:
1. Shall be installed where PVC mainline (two and one-half (2½) inches or larger) changes direction over twenty (20) degrees.
2. Minimum of one cubic foot of concrete shall be used per thrust block.
3. Keep pipe joints clean of concrete. Do not encase joint or pipe.
4. Place wiring away from thrust block to avoid contact with the concrete. Use clear plastic sheeting to isolate the concrete from other materials.

C. Valve Installation:
1. Install at least twelve (12) inches from and align with adjacent walls or paved edges.
2. Automatic Remote Valves: Install in such a way that valves are accessible for repairs. Make electrical connection to allow pigtail so solenoid can be removed from valve with twenty-four (24) inches (minimum) slack to allow ends to be pulled twelve (12) inches above ground.
    a. Flush completely before installing valve. Thoroughly flush piping system under full head of water for three minutes through furthest valve, before installing heads.
    b. Valve assembly to include ball valve and union for ease of maintenance and repair. The union should be between the ball valve and the electric control valve. For ball valves larger than two (2) inches, plastic ball valves may be used, Spears with Viton O-rings.
    c. Install in valve box per details.
3. Quick Coupler Valve: Install in ten (10) inch round locking valve box. Flush completely before installing valve. Thoroughly flush piping system under full head of water for three (3) minutes through furthest valve.
4. Isolation Gate Valves**:** Install in valve box as per detail.

D. Valve Boxes:
1. Brand all valve boxes with the following codes: "SV" and the controller valve number per as built plans for all remote control valves; "DV" for all drain valves; "GV" for all isolation valves; "DRGV" for all drip system isolation valves; "QC" for all quick coupling valves; "WA" for all winterization assemblies; "FM" for all flow meter assemblies; and "MV" for all master valve assemblies. Use a branding iron stamp with -inch high letters.
2. Valve box shall NOT rest on mainline. Use brick or other non-compressible material per detail. Top of valve box to be flush with finish grade. Use add-ons to depth of valve gravel.
3. Install valves in box with adequate space to access valves with ease. Valves shall not be too deep to be inaccessible for repairs. Three (3) inch depth of three-quarters (¾) inch washed gravel to be placed in the bottom of each valve box with enough space to fully turn valve for removal (see detail).

E. Head Installation:
1. Set heads plumb and level with finish grade. In sloped area, heads to be tilted as necessary to provide full radius spray pattern.
2. Flush lateral lines before installing heads. Thoroughly flush piping system under full head of water for three minutes through furthest head, before installing heads. Cap risers if delay of head installation occurs.
3. Pop-Up Heads Along Walks and Bikeways: Bed heads in 6-inch layer of sand under the base of the head. Heads should be two (2) inches from edge of walk.
4. Nozzles: Supply appropriate nozzle for best performance.
5. Adjustment: Adjust nozzles and radius of throw to minimize overspray onto hard surfaces.

F. Electrical Connections:
    1. New connections to be approved through City of Fort Collins Light & Power. Call 2216700 to obtain power information and request connection. Actual connection to transformer or other power source to be done by City of Fort Collins Light and Power. Work to be coordinated and scheduled with Light & Power at 221-6700. All work other than actual connection, including access to the transformer box where applicable, to be supplied by the contractor. All materials to be provided by the contractor. When working near any City Electric facility, prior coordination and approval is required.
G. Controller Installation:
    1. To be installed in an above ground location suitable to prevent vandalism and provide protection from adverse weather conditions, and per City direction. If a building is available, place controller inside building. All exposed wiring to and from the controller shall be encased in galvanized metal conduit. Exterior controllers to be installed on 6-inch-thick concrete pad.
    2. Install Controller per City direction and in accordance with manufacturers' specifications. Install surge protection, grounding rods and other accessory components as specified.
    3. Attach wire markers to the ends of control wires inside the junction box. Label wires with the identification number of the remote control valve activated by the wire. Then run 18-gauge wire to the controller.
H. Wiring:
    1. Comply with City of Fort Collins electrical codes.
    2. Power source brought to controller to a ground fault receptacle installed within controller casing.
    3. String control wires as close as possible to mainline, consistently along and slightly below one side of the pipe.
    4. Leave minimum loop of twenty-four (24) inches at each valve and controller and at each splice, at the ends of each sleeve, at one hundred (100) foot intervals along continuous runs of wiring, and change of direction of ninety (90) degrees or more. Band wires together at ten (10) foot intervals with pipe wrapping tape.
    5. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted. Install three extra wires, as specified, to the furthest valve on the system and/or each branch of the system, i.e. two (2) or more extra wires per twelve (12) valves.

3.04 TESTING

A. All tests to be run in the presence of City of Fort Collins Parks' representative. Schedule all tests a minimum of forty-eight (48) hours in advance of tests. Repeat any failed tests until full acceptance is obtained.
B. Pressure Test:
    1. Leave mainline uncovered at joints and fittings. Place a pressure gauge (capable of reading pressures up to one hundred-twenty (120) psi minimum) on a Quick Coupling valve attached to the system. Fill mainlines with water and bring to full pressure. If new system is an add-on to existing system, isolate the new system from the old system after filling. Record pressure readings at fifteen (15) minute intervals for four (4) hours. Pressure shall not drop more than ten percent (10%) of initial reading. If pressure drops more than ten percent (10%), a thorough walkthrough of the mainline shall be made to discover leakage and corrected. Repeat test until maximum desired pressure drop is achieved.
C. Operational Test:

1. Activate each remote control valve from the controller in the presence of City of Fort Collins Parks representative. Replace, adjust or move heads and nozzles as needed to obtain acceptable performance of system. Replace defective valves, wiring or other appurtenances to correct operational deficiencies.

3.05 COMPLETION SERVICES

A. When project construction is complete, request from Parks' representative a punch list inspection for Construction Acceptance:
   1. Demonstrate system to Parks and Recreation personnel.
   2. Provide Parks and Recreation personnel with ordering information including model numbers, size and style for all components.
   3. Provide one set of all electronic as built drawings, showing system as installed with each sheet clearly marked "AS-BUILT DRAWINGS", the name of the project and all information clearly provided. Final payment will not be released until as-built drawings are provide to the City of Fort Collins in a *.dwg and/or *.rvt format.
      a. All as-built drawings to include wiring diagrams for access control, and system wiring for building control system.
   4. Clean Up: Remove all excess materials, tools, rubbish and debris from site.

B. Once Construction Acceptance is obtained, begin warranty and maintenance period by contractor. Maintain irrigation system in optimal working condition for duration of period between Construction Acceptance and Final Acceptance. Make periodic adjustments to system to achieve most desirable application of water.

C. Request Final Acceptance inspection at least thirty (30) days before the end of one-year maintenance period, from City Parks Division personnel.
   1. Provide Parks and Recreation personnel operating keys, servicing tools, test equipment, warranties/ guarantees, maintenance manuals, and contractor's affidavit of release of liens. Keys, tools and other operating equipment need to be turned over to Parks. Submittal of all these items must be accompanied by a transmittal letter and delivered to the Parks offices (delivery at the project site is acceptable with signed receipt).

3.06 GUARANTEE/WARRANTY AND REPLACEMENT

A. For the period following Construction Acceptance Notice by City of Fort Collins, and prior to Final Acceptance, all irrigation materials, equipment, workmanship and other appurtenances are to be guaranteed/ warranted against defects. Settling of trenches or other depressions that damages structures or landscaping caused by settling and other defects to be corrected by the contractor at no cost to the City of Fort Collins. Make repairs within seven days of notification by the City of Fort Collins Parks' representative. Guarantee/Warranty applies to all originally installed materials and equipment, and to replacements made during the guarantee/ warranty period.

END OF SECTION 22 80 00

DIVISION 23: Heating, Ventilation, and Air Conditioning (HVAC)

23 05 00 – COMMON WORK RESULTS FOR HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for common work results for heating, ventilation, and air conditioning (HVAC). Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS

1.04 QUALITY ASSURANCE
- A. Start-up.

1.05 REGULATORY REQUIREMENTS
- A. Thermal Comfort Design Conditions
  1. For outdoor design conditions, confirm climate zone design parameters and discuss with project manager. City of Fort Collins specifies:
     a. Cooling: Ninety-five (95) degrees Fahrenheit dry bulb.
     b. Heating: Five (5) degrees Fahrenheit dry bulb.
  2. For indoor design calculations, the following conditions should be used unless otherwise discussed with project manager.
     a. Cooling: Seventy-five (75) degrees Fahrenheit dry bulb.
     b. Heating: Seventy (70) degrees Fahrenheit dry bulb.
  3. It is desirable that the most energy efficient options be considered, including:
     a. Outside Air for Cooling Systems: Systems should be designed with economy cycles that automatically allow the quantity of outside air supplied to the building to be varied to net maximum efficiency while maintaining indoor air quality.
     b. Energy and/or Heat Recovery Systems: Systems should be designed to provide as close to balanced outdoor and exhaust airflows as is practical for maximum benefit and efficiency.

1.06 DEFINITIONS
- A. EER
- B. SEER
- C. COP
- D. HSPF
- E. AFUE

PART 2 – PRODUCTS

2.01 NOISE AND VIBRATION CONTROL
- A. Provide vibration isolators for motor driven equipment.

2.02 ELECTRIC MOTORS
- A. All three-phase motors will have phase monitors. Include the following features on all motors:

1. Ball bearings with lube lines extended to accessible location.
2. Cast iron or steel base with provision for slide adjustment unless directed otherwise.
3. Conduit box with ample room for lead terminal connections.
4. Numbered leads of ample length for connection, terminating in the conduit box.
5. Permanently stamped nameplate.
6. Single speed one thousand-seven hundred-fifty (1750) RPM, unless specified otherwise.
7. Rated for continuous duty in ambient, not exceeding forty (40) degrees Celsius.

B. All motor wiring and windings shall be copper.

C. Power Factor:
1. Motors shall have a labeled power factor, at nameplate rating and rated voltage, of not less than eighty-five percent (85%). For motors five (5) hp and greater and not less than eighty percent (80%) for motors smaller than five (5) hp. If a motor draws less than one thousand (1000) watts labeled rating, it is excluded from the above P.F. requirement. If, through motor or design (i.e., RPM less than one thousand-two hundred (1200)), an eighty-five percent (85%) power factor is not available, the supplier of that motor shall furnish power factor correction components capable of correcting that non-conforming motor to ninety percent (90%) or better.

D. Energy Efficient:
1. Electric motors less than one (1) hp and greater than/equal to 0.5 hp shall be specified as Electronically Commutated Motor (ECM) type.
2. Electric motors one (1) hp and greater shall be of the premium efficiency type as defined by the Consortium for Energy Efficiency (CEE). Motors shall have a nominal nameplate efficiency that meets or exceeds the values in Table 1. Those motors that exceed the efficiency requirements listed in Table 1 by at least one numeric percent qualify as an “Enhanced” Premium efficient electric motor under the Xcel Energy Rebate program.

E. Three-Phase Motors: Furnish for all applications one (1) hp and larger, three (3) phase general purpose, drip-proof, squirrel cage induction motors, for 208V, 60Hz current.

F. Motors used with adjustable speed drives to be inverter duty and compatible with the drive.

G. Motors to be sized for an operating load factor between sixty percent (60%) and seventy-five percent (75%).

PART 3 – EXECUTION

3.01 CLEANING AND PROTECTION

A. Disinfecting and Special Cleaning

B. Adhere to LEED standards for cleaning.

3.02 INSTALLATION

A. Start-Up:
1. Provide factory start up services for the chiller and the tower.
2. Engage a factory-authorized service representative to perform startup service.
3. Verify operation of tower basin automatic blowdown, and controlling device.
4. Prepare a written startup report that records the results of tests and inspections.

B. Connections
1. Install flexible pipe connectors at final connections of towers.

C. Adjusting
1. Set and balance water flow to each tower inlet.
2. Adjust water-level control for proper operating level.
3. Occupancy Adjustment: May be required – TBD per project.

D. Demonstration
   1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

END OF SECTION 23 05 00

23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for hangars and supports for HVAC piping and equipment.
  1. Types of supports and anchors specified in this section include the following:
     a. Hanger-rod attachments.
     b. Building attachments.
     c. Saddles and shields.
     d. Spring hangers and supports.
     e. Miscellaneous materials.
     f. Roof equipment supports.
     g. Anchors.
     h. Equipment supports.
  2. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other sections.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Certifications.
- D. O&M Data.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Hangers and Supports
  1. Install noise and vibration insulation per industry standards.
- B. Equipment Supports
  1. Housekeeping pads shall be four (4) inch thick minimum, or thicker to allow maintenance access, extended four (4) inches beyond machinery bedplates.

END OF SECTION 23 05 29

23 05 53 – IDENTIFICATION FOR HVAC EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for identification for HVAC equipment.
   1. Plastic tape.
   2. Plastic duct markers.
   3. Valve tags.
   4. Valve schedule frames.
   5. Engraved plastic-laminate signs.
   6. Equipment markers.
   7. Plasticized tags.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Schedules.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mechanical Equipment Identification
   1. Install equipment marker on each individual items of mechanical equipment. Provide signs for the following general categories of equipment.
      a. Main building systems control and operating valves, including safety devices and hazardous units such as gas outlets.
      b. Room thermostats.
      c. Fuel-burning units including boilers and water heaters.
      d. Pumps, chillers, and similar motor-driven units.
      e. HVAC units.
      f. Tanks and pressure vessels.
      g. Water treatment systems and similar equipment.
   2. Test of Signs: In addition to the identified unit, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
      a. No sharpie. Must be an engraved equipment tag on equipment exterior. Interior ceiling grid labelled using a label maker.

3.02 CLEANING AND PROTECTION

A. View of mechanical identification devices are not to be obstructed.

END OF SECTION 23 05 53

23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for testing, adjusting, and balancing for HVAC. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. General
   1. Firm having total professional responsibility for the final testing, adjusting and balancing of the entire system, air and hydronic. All balancing shall be performed by qualified technicians in the employ of the pre-qualified firm.
   2. Instruments shall be used and applied which are best suited to the system function being tested. Make sure instruments are calibrated per industry standard. Instruments shall be recalibrated upon completion of the job if required by the Design Engineer to prove reliability.
   3. After all adjustments are made; a detailed written report shall be prepared and submitted for approval. Final acceptance of this project will not be made until a satisfactory report is received and verified.

B. Air Balancing Procedures to be determined by manufacturer's recommendation and Design Engineer's requirements.

C. Hydronic Balancing Procedures to be determined by manufacturer's recommendation and Design Engineer's requirements.

END OF SECTION 23 05 93

23 07 00 – HVAC INSULATION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes:
  1. Equipment Insulation: Fiberglass, calcium silicate.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Samples.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Equipment Insulation

END OF SECTION 23 07 00

23 08 00 – COMMISSIONING OF HVAC

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for commissioning HVAC. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS

A. Closeout Report.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 START-UP

A. Start-up must be completed by the manufacturer's representative.

B. TAB cannot be completed until start-up.

C. Commissioning to verify start-up and balance reports.

END OF SECTION 23 08 00

23 30 00 – HVAC AIR DISTRIBUTION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for HVAC air distribution. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE
- A. Meet most current City of Fort Collins code standards.

PART 2 – PRODUCTS

2.01 BALANCING DAMPERS
- A. Approved manufacturers only. Install upstream of each supply register or diffuser.

2.02 SHEET METAL WORK
- A. All ductwork shall be constructed in accordance with SMACNA requirements.

2.03 EXHAUST FANS
- A. Twelve (12) inch minimum roof curb and neoprene gasket required.
- B. All exhaust fans over one-quarter (¼) horsepower shall be belt driven.
- C. All fans shall be dynamically and statically balanced at the factory.
- D. Fan ratings shall be based upon tests performed in strict accordance with the AMCA Standard 210-67 Test Code for Air Moving Devices. Each fan shall carry, near the manufacturer's nameplate, the seal authorized by AMCA indicating that ratings are certified. Fans not bearing this seal will not be acceptable

2.04 ROOFTOP AIR CONDITIONING
- A. Manufacturers
  1. Prior approved product.
- B. Controls: All RTU's will be compatible with BAS system being used.
- C. Provide highest efficiency available, or conform with basis of design.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 30 00

23 31 13 – DUCTWORK

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for ductwork. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Record Drawings.
- D. Maintenance Data.

1.04 QUALITY ASSURANCE
- A. Manufacturer's Qualifications: Similar service for not less than five (5) years.
- B. Installer's Qualifications: At least three (3) years of successful installation
- C. References to SMACNA, ASHRAE and NFPA are minimum requirements.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Protection: Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Cleaning: Clean shop and factory-fabricated ductwork and accessories at the time of fabrication, and protect from dirt and debris with shrink-wrap or equivalent pallet wrap.
- C. Storage: Store ductwork inside and protect from weather.
- D. Temporary Closure: At ends of ducts polyethylene film or other covering.

PART 2 – PRODUCTS

2.01 DUCTWORK MATERIALS
- A. Exposed Ductwork Materials: Free from visual imperfections including pitting, seam marks, roller marks, stains, dents, discolorations, and other imperfections, including those which would impair painting.

2.02 DUCTWORK
- A. External Wrap (Thermal):
  1. Do not install insulation over access panels.
- B. Internal Liner (Sound) (Rectangular Ducts).

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Installation of Metal Ductwork
  1. All ductwork shall be sealed.
  2. Routing: Vertically and horizontally and avoid diagonal runs wherever possible. Run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- B. Ductwork and Duct Accessories

1. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3.02 CLEANING AND PROTECTION

A. Field Quality Control
   1.

B. Equipment Connections
   1. Provide and coordinate access doors for service, maintenance and inspection of ductwork accessories.

END OF SECTION 23 31 13

23 33 00 – AIR DUCT ACCESSORIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for air duct accessories. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Record Drawings.
- D. Maintenance Data.

1.04 QUALITY ASSURANCE
- A. Manufacturers' Qualifications: Not less than five (5) years.

PART 2 – PRODUCTS

2.01 ACCESS PANELS
- A. Permit inspection and maintenance of all automatic dampers, fire dampers, control equipment, coils, and other equipment requiring maintenance. Panels shall not be located in top side of ducts. Ceiling panels to be compatible with type ceiling used.
- B. Where duct size permits, access panels shall be minimum eighteen (18) inches by sixteen (16) inches or two (2) inches smaller than duct size, whichever is smaller.

2.02 FLEXIBLE CONNECTIONS
- A. Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment. Shelf life shall be verified to not exceed six (6) months. Any sign of cracking on interior or exterior shall be cause for replacement immediately.
- B. Flexible pipe shall be kept to a length not to exceed thirty-six (36) inches.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Installation of Ductwork Accessories
  1. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
  2. Where fire/smoke dampers are installed in rated construction, provide firestopping between fire smoke damper sleeve and substrate.
- B. Field Quality Control
  1. Test every fire/smoke damper for proper operation, letter REQUIRED certifying this work is complete and all dampers are functioning properly.

3.02 CLEANING AND PROTECTION
- A. Adjusting and Cleaning

1. Label access doors in per label and identification requirements.
2. Final positioning of manual dampers.

B. Extra Stock
1. One EXTRA FUSIBLE link for every ten (10) installed of each temperature range; obtain receipt.

END OF SECTION 23 33 00

23 34 00 – HVAC FANS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for HVAC fans. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Shop Drawings.
- C. Wiring Diagrams.
- D. Record Drawings.
- E. Maintenance Data.

1.04 QUALITY ASSURANCE
- A. Manufacturer’s Qualifications: Similar service for not less than five (5) years.

PART 2 – PRODUCTS

2.01 FANS, GENERAL
- A. Factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Demonstration
  1. Demonstration Services: Factory-authorized service representative to train Owner's maintenance.
     a. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
     b. Familiarization with contents of O&M Manuals.

END OF SECTION 23 34 00

23 37 00 – AIR OUTLETS AND INLETS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for air outlets and inlets. Additional requirements may be included within specific agreements or other contracting documents.

1.03 REGULATORY REQUIREMENTS

A. Do not use fiberglass ductwork.

B. Ductwork exposed on roofs is strongly discouraged. Review with the owner any proposed exposed ductwork.

C. Consultant to specify pressure, air speed, and show on drawings using SMACNA standards.

D. Do not use splitter dampers.

E. Consultant to provide a specific list of work items for renovation of existing equipment and duct work. Global statements to rehabilitate "as required or necessary" are not acceptable.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 37 00

23 50 00 – CENTRAL HEATING EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for central heating equipment. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 STRAINERS
- A. Conform to design and industry best practices.

2.02 AIR SEPARATOR
- A. Separator shall be the centrifugal type, with strainer, line size, with a Hoffman #79 auto air release valve. One hundred-twenty-five (125) psi working pressure. Pipe discharge to floor drain.
- B. Air separator shall be suitably supported in piping system with clearance provided for strainer removal.

2.03 AIR VENTS
- A. Provide manual (not automatic) air vent valves at the high point wherever drops occur in the direction of water flow, at the top of all supply risers and at the high point of return risers on all hot water heating supply and return mains. Air vent ball valves shall be installed on the top of the risers in an accessible location.
- B. Add air vents to high points in RTU piping.
- C. Provide isolation ball valves for replacement.

2.04 BACKFLOW PREVENTER
- A. Acceptable Manufacturers: Watts. Watts 909QT only.
- B. Shall be the reduced pressure type with atmospheric vent, for boiler water make-up.
- C. Bronze body and accessory construction and replaceable seats.
- D. Bronze body ball valve test cocks, unions, full port ball valve shut-offs on inlet and outlet, and bronze inline strainer.
- E. Watts Model U909 QTS, three-quarters (¾) inch size with strainer on inlet side and spring check valve on upstream side.

2.05 HOT WATER HEATING COILS
- A. Supervise all installations to ensure proper pitch for drainage and venting. Make all connections and install all specialties as detailed after installation in duct system.
- B. Coils shall be isolated with ball valves and balance valves, installed to allow easy coil removal.

2.06 HOT WATER HEATING PUMP AND DOMESTIC HOT WATER CIRC PUMPS
- A. Provide one (1) extra set of mechanical seals for each pump.
- B. Ball valve isolations on each side of pumps.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 50 00

23 52 00 – HEATING BOILERS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for heating boilers. Additional requirements may be included within specific agreements or other contracting documents.
- B. Heating water boilers only, no steam except in limited applications in old buildings to replace like equipment.

1.03 REGULATORY REQUIREMENTS
- A. Heating water boilers only, no steam except in limited applications in old buildings to replace like equipment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Owner approved.

2.02 PRODUCTS
- A. Controls
  1. BAS will be able to interface via BACnet with the boiler.
  2. Temperature controller capable of interfacing with temperature controls shall be supplied as a part of the boiler package. Sequence of operation by the Consultant.
  3. Water Boiler Standard Controls:
     a. Conform to design and manufacturer requirements.
- B. Burner
  1. Burner Startup and Combustion Test:
     a. Factory-authorized technician shall perform start-up.
     b. A complete combustion analysis test report shall be submitted to the Engineer.
     c. Minimum efficiency of boilers. All packaged boilers shall be highest efficiency possible where applicable.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Provide a single four (4) inch minimum raised reinforced concrete housekeeping pad for all boiler units that rest on top of the boiler room floor.

END OF SECTION 23 52 00

23 60 00 – CENTRAL COOLING EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for central cooling equipment. Additional requirements may be included within specific agreements or other contracting documents.

B. Special design considerations shall be given for server room cooling installations. Systems shall be right sized according to the application and consider outdoor air use. Special considerations include:

1. Setpoints are different than those set for thermal comfort. IT equipment and server room setpoints shall be discussed.
2. Design shall consider exhaust and heat removal from server rooms.
3. Design shall consider point-specific airflow for racks.
4. Equipment closets shall be considered different than server room closets in design.
5. Design shall observe a hot aisle cold aisle configuration.

PART 2 – PRODUCTS

2.01 AUTHORIZED TYPES: CHILLER

A. Minimum efficiency of chillers. All packaged chillers shall have the highest efficiency available, or conform to the basis of design.

2.02 SPLIT SYSTEMS

A. Minimum efficiency of split systems. All packaged split systems shall have the highest efficiency available, or conform to the basis of design.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 60 00

23 65 13 – FORCED-DRAFT COOLING TOWERS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for forced-draft cooling towers. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 HANDRAILS, LADDERS, AND PLATFORMS

A. Platforms: Galvanized steel with a bar grating floor.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 65 13

23 71 20 – GLYCOL SYSTEMS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for glycol systems. Additional requirements may be included within specific agreements or other contracting documents.

B. Types of glycol system specialties specified in this section include the following:

1. Propylene glycol.
2. Feed pump.
3. Provide glycol feeder for all new construction and anytime a boiler room is being upgraded. Engineer to size the feeder.
4. Provide a combination pot feeder and filter system with filter socks unless previously installed by owner.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Maintenance Data.

C. Test Results.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Perform tests determining strength of propylene glycol solution before system is turned over to the Owner. Provide test prior to end of the first year of operation and replenish as required.

END OF SECTION 23 71 20

23 74 00 – PACKAGED OUTDOOR HVAC EQUIPMENT

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for packaged outdoor HVAC equipment. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED
- A. Product Data.
- B. Wiring Diagrams.
- C. Record Drawings.
- D. Maintenance Data.
- E. Extra Stock: Obtain receipt from Owner that new filters have been installed at the end of the construction before owner take over.

1.04 QUALITY ASSURANCE
- A. Manufacturers' Qualifications: Not less than five (5) years.
- B. Training is required.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Outdoor Air Handling Units: All must be approved by Owner.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 74 00

DIVISION 25: Integrated Automation

25 05 00 – COMMON WORK RESULTS FOR INTEGRATED AUTOMATION

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for integrated automation. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Hardware Sensors.

B. Add network riser diagram.

C. Point to point checkout sheet.

1.04 REGULATORY REQUIREMENTS

A. The Controls Contractor shall be a fully owned subsidiary of the control manufacturer or factory authorized installer of the major control components and has been in continuous business for at least five (5) years.

B. Include the listed temperature control drawings among the final contract drawings and make them the same size and of the same sheet material as the other contract drawings no matter what their source, consultant or installing contractor. The Mechanical Engineer, not the controls contractor, is responsible to see that control drawings meet this standard.

1. Floor and roof plan showing thermostat and equipment locations.
2. Require point-to-point connection diagrams for wiring or pneumatic tubing from the Controls Contractor.
3. Schematic instrumentation and control flow diagram labeled accurately and showing the interrelationship of all controls and the areas and equipment served.
4. Show the sequence of operation on the contract documents. The bill of materials shall appear on the Control Contractor's drawings.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Locate each individual equipment controller near the equipment served and label its function.

B. The Controls Contractor is responsible for preassembling and installing panels and all hardware with his own employees, proving the system and training City people in its proper function and maintenance.

C. Wiring, conduit placement and the installing of actuators and related linkage may be subcontracted to a City approved installer but in this case the controls contractor shall label and connect all wiring terminations and be responsible for the subcontractor's work.

3.02 DEMONSTRATION AND TRAINING

A. Twelve (12) hours at each elementary or eighteen (18) hours at each middle or high building to demonstrate the controls to City personnel and answer questions.

B. Optionally twenty-four (24) hours minimum of formal classroom training to City personnel in the theory, function and application of each hardware and software element and each component in the control system, plus eight (8) hours of telephone consultation.
C. The Consultant shall confer with the Owner at the time of design to determine how much training will be required by the construction documents.

3.03 QUALITY ASSURANCE

A. Plenum rated cable inside of plenums. Wiring suspended neatly from the overhead structure. Do not support on top of ceiling tiles.
B. Number or color code wiring terminals and provide a cross reference to ease later checkout and diagnosis.
C. Place exposed control wiring in conduit with proper identification.

3.04 SENSORS

A. No display or user interface.

3.05 ACCESSIBILITY

A. Install all control devices in "Readily Accessible" locations.

END OF SECTION 25 05 00

25 09 23 – DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for direct-digital control systems for HVAC.
   1. Central DDC Panel.
      a. The term Central DDC Panel refers in this document to the main DDC controller in the controlled building that acts as the hub for communication with individual equipment controllers holds most or all of the control software, connects directly to the modem and resides in the Communications Room. Actual nomenclature will differ among manufacturers.
   2. Software to monitor and control HVAC operations.

B. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide a printed copy of the final sequence of operations and a point assignment list.

B. Present sixteen (16) training hours in the proprietary software in addition to controls training required elsewhere. The Consultant shall confer with the Owner prior to issuing construction documents to determine the amount of training desired.

END OF SECTION 25 09 23

25 13 00 – INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK (DASHBOARDS)

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for integrated automation control and monitoring network (dashboards). Additional requirements may be included within specific agreements or other contracting documents.

B. Provide requirements that will ensure that buildings are constructed or altered in a way that will provide the capability for their energy use, production and reclamation to be measured, monitored and reported. This includes the design of energy distribution systems so as to isolate load types, the installation of or the ability to install in the future meters, devices and a data acquisition system, and the installation of or the ability to provide for public displays and other appropriate reporting mechanisms in the future.

C. All forms of energy delivered to the building and building site, produced on the building site or in the building and reclaimed at the building site or in the building shall be metered and all energy load types measured.

D. The intent of these requirements is to provide for the ongoing meterability, metering, measuring, reporting and display of the energy use, energy demand and emissions associated with the energy use of the whole building and its systems.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Samples.

PART 2 – PRODUCTS

2.01 ENERGY DISTRIBUTION DESIGN REQUIREMENTS AND LOAD TYPE ISOLATION

A. Energy distribution systems within, on or adjacent to and serving a building shall be designed such that each primary circuit, panel, feeder, piping system or supply mechanism supplies only one energy use type as defined. The load type served by each supply mechanism shall be clearly designated with the use served, and adequate space shall be provided for installation of metering equipment or other data collection devices, temporary or permanent, to measure these loads. The energy distribution system shall be designed to facilitate the collection of data for each of the building energy use categories and for each of the end use categories listed. Where there are multiple buildings on a building site, each building shall comply separately.

1. Exception: Buildings designed and constructed such that the total usage of each of the load types described shall be permitted to be measured through the use of installed submeters or other equivalent methods as approved.
2. HVAC System Total Energy Use: This category shall include all energy used to heat, cool, and provide ventilation to the building including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.
3. Lighting System Total Energy Use: This category shall include all interior and exterior lighting used in occupant spaces and common areas.

4. Energy Used for Building Operations: This category includes all energy use by vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains and fireplaces, swimming pools, snow-melt systems, and all other building operations.
5. Miscellaneous loads. Loads other than those specified.

2.02 ENERGY TYPE METERING

A. Buildings shall be provided with the capability to determine energy use and peak demand for each of the energy types. Utility energy meters shall be permitted to be used to collect whole building data, but shall be equipped with a local data port connected to a data acquisition system.
   1. Gaseous Fuels: Gaseous fuels including, but not limited to, natural gas, LP gas, coal gas, hydrogen, landfill gas, digester gas and biogas shall be capable of being metered at the building site to determine the gross consumption and peak demand of each different gaseous fuel by the building and each building on a building site. The installation of gas meters and related piping shall be in accordance with the International Fuel Gas Code.
   2. Liquid Fuels: Liquid fuels including, but not limited, to fuel oil, petroleum-based diesel, kerosene, gasoline, bio diesel, methanol, ethanol and butane shall be capable of being metered at the building site to allow a determination of the gross consumption and peak demand of each liquid fuel use by the building and each building on a building site. The installation of meters and related piping shall be in accordance with the International Mechanical Code.
   3. Solid Fuels: Solid fuels including, but not limited to coal, charcoal, peat, wood products, grains, and municipal waste shall be capable of having their use determined at the building site to allow a determination of the gross consumption and peak demand of each solid fuel use by the building and each building on a building site.
   4. Electric Power: Electric power shall be capable of being metered at the building site to allow a determination of the gross consumption and peak demand by the building and each building on a building site. The installation of electric meters and related wiring shall be in accordance with NFPA 70.
   5. City Heating and Cooling: Hot water, steam, chilled water, and brine shall be capable of being metered at the building site, or where produced on the building site, to allow a determination of the gross consumption of heating and cooling energy by each building on a building site. Energy use associated with the production of hot water, steam, chilled water or brine shall be determined based on the fuel used.
   6. Combined Heat and Power: Equipment and systems with a connected load greater than 125,000 Btu/hr providing combined heat and power (CHP) shall be capable of being metered to allow a determination of the gross consumption of each form of delivered energy to the equipment. The output of CHP shall be metered based on the form(s) of output from the CHP.
   7. Renewable and Waste Energy: Equipment and systems providing energy from renewable or waste energy sources, or from which energy is included in the determination of the building TANEU shall be capable of being metered to allow a determination of the output of such equipment and systems.
      a. Solar Electric: Equipment and systems providing electric power through conversion of solar energy directly to electric power shall be capable of being metered such that the peak electric power (kW) provided to the building and its systems or to off-site entities can be determined at fifteen (15) minute intervals and the amount of electric power (kWh) provided to the building and its systems can be determined at a minimum of hourly intervals.

b. Solar Rhermal: Equipment and systems providing heat to fluids or gases through the capture of solar energy shall be capable of being metered such that the peak thermal energy (Btu/hr) provided to the building and its systems or to off-site entities can be determined at fifteen (15) minute intervals and the amount of heat captured (Btu) for delivery to the building and its systems can be determined at a minimum of hourly intervals.
c. Waste Heat: Equipment and systems providing energy through the capture of waste heat shall be capable of being metered such that the amount of heat captured and delivered to the building and its systems can be determined at a minimum of hourly intervals.
d. Wind Power Systems: Equipment and systems providing electric power through conversion of wind energy directly to electric power shall be capable of being metered such that the peak electric power (kW) provided to the building and its systems or to off-site entities can be determined at fifteen (15) minute intervals and the amount of electric power (kWh) provided to the building and its systems can be determined at a minimum of hourly intervals.
e. Other Renewable Energy Electric Production Systems: Equipment and systems providing electric power through conversion of other forms of renewable energy directly to electric power shall be capable of being metered such that the peak electric power (kW) provided to the building and its systems or to off-site entities can be determined at fifteen (15) minute intervals and the amount of electric power (kWh) provided to the building and its systems can be determined at a minimum of hourly intervals.

2.03 ENERGY LOAD TYPE SUB-METERING

A. For buildings that are twenty-five thousand (25,000) square feet in total building floor area and larger, all of the Energy Load Types as defined above shall be metered through the use of sub-meters or other approved, equivalent methods.
B. Buildings Less Than Twenty-Five Thousand (25,000) Square Feet: For buildings that are less than twenty-five thousand (25,000) square feet in total building floor area, the energy distribution system shall be designed and constructed in such a way as to accommodate the future installation of sub-meters and other approved devices. This includes, but is not limited to, providing access to distribution lines and ensuring adequate space for the installation of sub-meters and other approved devices.

2.04 MINIMUM ENERGY MEASUREMENT AND VERIFICATION

A. Meters sub-meters, and other approved devices installed shall be connected to a data acquisition and management system capable of storing not less than thirty-six (36) months' worth of data collected by all meters and other approved devices and transferring the data in real time to a display.
B. Annual Emissions: The data acquisition and management system shall be capable of providing the data necessary to calculate the annual CO2e emissions associated with the operation of the building and its systems using the results of annual energy use measured. The calculation shall be based on energy measured for each form of energy delivered to the site on an annual basis.

2.05 ENERGY DISPLAY

A. A permanent, readily accessible and visible display shall be provided adjacent to the main building entrance or on a publicly available internet website. The display shall be capable of providing all of the following:
B. The current energy demand for the whole building level measurements, updated for each fuel type at the intervals specified above.
C. The average and peak demands for the previous day and the same day the previous year.
D. The total energy usage for the previous twelve (12) months.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 25 13 00

DIVISION 26: Electrical

26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for maintenance testing of electrical systems. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Specified tests shall be performed and witnessed by a City Electrical Department Representative as a requirement for final payment. Explain the functions and demonstrate the operation of major equipment. Tests to be run on the following systems (minimum one (1) hour per system):
   1. Fire alarm.
   2. Clock system.
   3. Emergency generator system.
   4. Exterior lighting controls.
   5. Other special systems.
   6. Special lighting system.

END OF SECTION 26 01 26

26 01 11 – ARC FLASH HAZARD STUDY

05/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for arc flash hazard studies. Additional requirements may be included within specific agreements or other contracting documents.

B. Minimum requirements of this specification should be incorporated into all new as well as renovated construction projects that include electrical system installations or modifications.

C. The contractor shall furnish an arc flash hazard study as prepared by an engineering services company.

D. References

1. All applicable standards.

1.03 SUBMITTALS

A. The arc flash incident energy and flash safety labeling shall be submitted to the Architect prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Architect may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

B. Arc flash evaluation and required protective FR clothing class signage for all electrical equipment.

C. The results of the arc flash incident energy and flash safety labeling shall be summarized in a final report. Submit a digital copy of the complete final report.

D. The report shall include the following sections:

1. One-line diagram.
2. Arc flash calculations and arc flash values, protective clothing and procedure for all electrical equipment.
3. Executive summary.

E. Report Sections

1. Input Data:
    a. Cable and conduit materials.
    b. Transformers.
    c. Circuit resistance and reactive values.
2. Arc Flash Study to include:
    a. Perform an arc flash hazard study.
    b. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.
    c. The study shall be in accordance with applicable NFPA 70E, OSHA 29-CFR. Part 1910 Sub part S and IEEE 1584 Standards.
    d. Determine the following:
        i. Flash hazard protection boundary.

ii. Limited approach boundary.
iii. Restricted boundary.
iv. Prohibited boundary.
v. Incident energy level.
vi. Required personal protective equipment class.
vii. Type of fire rated clothing.

e. Produce an Arc Flash Warning label listing items d. above. Labels shall be printed in color and be printed on adhesive backed Avery labels.
f. Produce Bus Detail sheets that list the Items in 1.03.G.3. from above and the following additional items:
   i. Bus name.
   ii. Upstream protective device name, type and settings.
   iii. Bus line to line voltage.
g. Produce Arch Flash Evaluation Summary Sheet listing the following additional items:
   i. Bus name
   ii. Upstream protective device name, type and settings.
   iii. Bus line to line voltage.
   iv. Bus bolted fault.
   v. Protective device bolted fault current.
   vi. Arcing fault current.
   vii. Protective device trip/delay time.
   viii. Breaker opening time.
   ix. Solidly grounded column.
   x. Equipment type.
   xi. Gap.
   xii. Arc flash boundary.
   xiii. Working distance.
   xiv. Incident energy.
   xv. Required protective fire rated clothing type and class.

1.04 QUALTY ASSURANCE

1. The arc flash hazard study shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the arc flash hazard study. The Registered Professional Electrical Engineer shall be registered in Colorado and a full-time employee of the Engineering Services Company.

PART 2 – PRODUCTS (NOT USED)

2.01 PRODUCT

A. Contractor to furnish arc flash hazard study as prepared by Engineering Services Company. Study shall include service from City of Fort Collins utility down to lighting and power panelboards.
B. Provide arc flash evaluation and labeling for all electrical equipment with signage as required by NEC 110.16.

PART 3 – EXECUTION

3.01 PREPARATION

A. Data Collection
   1. Contractor shall furnish all data as required by the arc flash hazard study.

3.02 EXECUTION

B. Arc flash hazard warning labels on all equipment. Install labels on the face of equipment.
C. Arc Flash Hazard Study
    1. Use typical conductor impedances based on most current standards.
    2. Transformer design impedances shall be used when test impedances are not available.
    3. Provide the following:
    4. Calculation methods and assumptions.
    5. Selected base per unit quantities.
    6. One-line diagram of the system being evaluated.
    7. Source impedance data, including electric utility system and motor fault contribution characteristics.
    8. Typical calculations.
    9. Tabulations of calculated quantities.
    10. Results, conclusions, and recommendations.

END OF SECTION 26 01 11

26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results of electrical. Additional requirements may be included within specific agreements or other contracting documents.

B. Electrical design and installation shall, as a minimum, use the most recent applicable versions or regulatory requirements of the following:

1. Federal and State Regulations
2. OSHA
3. NEC
4. ANSI/NFPA 70
5. NEMA
6. IEEE
7. ANSI
8. ANSI/IEEE C2
9. Local Protective Signaling Systems
10. NFPA 72A
11. Fire Detection in Mechanical Systems
12. NFPA 90A
13. NFPA 101A
14. Life Safety Code

1.03 INTENT

A. These technical specifications are for guidance only. These guidelines are founded on considerable design and maintenance experience with the intent of reducing future maintenance problems and extending the trouble-free life of expensive equipment. With these overall goals in mind, the consulting engineers should apply these design priorities consistent with budget constraints:

1. Occupant safety.
2. Low life cycle cost of equipment including maintenance and energy.
3. Arc Flashing hazard study.

1.04 SUBMITTALS REQUIRED

A. As-Built Drawings

1. Use the red-lined drawings maintained by the Contractor during construction.
    a. One-line diagram(s) with revised load calculation.
    b. Accurate routing of wiring.
    c. Locations of panels and loads.
    d. Point-to-point connection diagrams.
    e. Accurately locate buried conduit.
    f. Accurate circuit connection designations.

B. Schematic Drawings

1. Include schematic diagrams and point-to-point wiring diagrams for the following systems.

a. Clock systems.
b. Electrical systems control.
c. Fire detection/ alarm systems.
d. Lighting/ dimming control systems.
e. Medium voltage equipment.
f. Motor control systems.
g. Kitchen hood fire control panel.
h. Communication system (rough-in).
i. Security systems (rough-in).
j. Stage lighting systems.
k. Sound systems.

PART 2 – PRODUCTS

1.05 GENERAL DESIGN GUIDELINES

A. Provide receptacle outlets in the following areas. Small Rooms: One duplex receptacle at door forty-eight (48) inches (to operable part) AFF, Custodian Closet, Mechanical Rooms, Storage Areas. Large Mechanical Rooms: One duplex on all walls forty-eight (48) inches (to operable part) AFF.
B. New branch circuits needing a neutral, installed from the panelboard shall have an individual neutral wire installed for the circuit. Sharing a neutral in multi-wire branch circuits is not permitted.
C. Vehicle charging stations. Coordinate with Owner for exact location and quantity. All parking lots and garages to include charging stations.

PART 3 – EXECUTION

3.01 PREPARATION

A. Include in the O&M manual certifications received with any electrical equipment and data for any equipment tests performed.
B. Label main electrical gear with the name, voltage, phase, amp rating, source, and destination of power.
C. Remove construction debris and leave areas broom clean after construction. In electrical rooms, the MDC shall be vacuumed and contacts dusted.
D. Label all spare conduits on the ends as to where it originates and terminates. Install pull string in each empty conduit. (Exception: it is not necessary to label spare conduits directly above an electrical panel.)

3.02 INSTALLATION

A. Anchors:
    1. Only anchors that use removable bolts or screws are allowed. Screw type anchors approved for the application will be the only type of fastener accepted. Anchors shall be used and approved for use per manufacturer instructions. Examples listed.
        a. Nail in or Pin type anchors shall not be used to mount fixtures, straps, boxes, or any device associated with the electrical system.
B. Boxes:
    1. J-boxes in boiler rooms, mechanical/electrical rooms, storage rooms or above ceilings shall be a minimum of two and one-eighth (2-1/8) inch deep, four (4) inch square boxes with combo one-half (½) inch and three-quarter (¾) inch concentric KO's.

2. Any boxes in public areas shall be cast weather-proof type or wire mold (mid-depth i.e. 5748)
3. One extension box is permitted on remodel work to extend existing installations. Where more than one box is needed to flush out installation, provide a larger (i.e. six (6) inches by six (6) inches minimum) box to flush out the existing box and nipple over to a new box.
4. Floor boxes for cast-in-place concrete floors:
    a. Prohibited without written approval from Owner.
    b. Must be fully adjustable, cast iron or formed galvanized steel.
    c. Front face shall be perpendicular to the floor to prevent entrance of liquids and debris.

C. Conduit: To be used for raceways unless MC Cable requires prior approval.
D. Fixtures (luminaire):
1. Wall-pack fixtures shall be hung with metal or lead type expanding anchors with a minimum of one-quarter (¼) inch machine screw to fasten on masonry walls; plastic or drive-in 'button head' nail type wedge anchors are not to be used.
2. Fixtures mounted on drywall should use toggle bolts or screwed into wall stud or other framing member. Do not use screw in type anchors. (i.e.: E-Z anchor)

E. Labeling/Identification:
1. All electrical panels and equipment shall be labeled. All labels shall be engraved plastic, white letters on black background. Labels shall be attached with screws or rivets. No pressure sensitive adhesives will be allowed.
2. The following equipment shall have a plastic nameplate with a minimum letter height of one-quarter (¼) inches:
    a. Main service feeder switch or circuit breaker.
    b. Sub-distribution equipment.
    c. Main switchboard and panel.
    d. All sub-distribution panelboards and special equipment and boxes.
3. The following equipment shall have a plastic nameplate with a minimum letter height of three-sixteenth (3/16) inches:
    a. Each separately mounted disconnect and starter for a motor or fixed appliance. Nameplate shall also provide the motor designation, voltage, and phase. (Panel and circuit number)
4. The following equipment shall have a plastic nameplate with a minimum letter height of one-quarter (¼) inches:
    a. All branch circuit panelboards, complete with voltage and phase.
    b. All branch circuit panelboards shall have their directories neatly typed.
5. All switches that control mechanical equipment, pumps, fans, boilers, etc., shall have plastic nameplates with a minimum letter height of one-eighth (1/8) inches.
6. Device covers (receptacles, switches) shall be labeled neatly with a label maker with panel & circuit number. (ex. L1A-10)
7. On the cover of each junction box and pull box: the circuit number(s) of the enclosed conductors are to be legibly written with the system identification.
8. All disconnects & motor starters shall be labeled with panel and circuit number.

F. Motors:
1. No contactors, transformers, or control devices to be located above ceilings (no hanging transformers), unless approved by the Owner.
2. Transformers to be Energy Star.

3. Phase Protection: All motors using three (3) phase power and three (3) phase air conditioning units shall have protection for phase reversal, loss of phase, or phase unbalance of ten percent (10%) voltage drop or greater on any one phase.
4. Provide proper rotation of all motors.
5. All motors to be premium efficient motors minimum. Ultra-efficient motors are preferred if available.

G. Receptacles:
1. Receptacles shall be 20A commercial grade. Duplex receptacles shall be extra heavy-duty type with nylon fronts and backs.
2. Devices must be pigtailed from branch circuit for ease of device removal or replacement.
3. All unused screws on the receptacles or switches shall be in a tightened position.
4. Provide a dedicated circuit to outside receptacles with an override or timer

H. Switches:
1. Switches shall be extra heavy-duty type with nylon fronts and backs.
2. Keyed switches shall be P&S 20AC1-L Series. No exceptions.
3. Devices must be pigtailed from branch circuit for ease of device removal or replacement.
4. Switches for life safety circuits shall be red.

I. Tying into Circuits:
1. Leave splices long enough to tap for future use. If new wires are being run through a box, leave a loop big enough to splice into at a later date.

J. Wire:
1. Conductor type:
   a. Conductors #10 AWG and larger, stranded copper.
   b. Conductors #12 AWG can be solid or stranded copper.
   c. Conductors #14 AWG can be solid or (stranded copper, depending on application.)
   d. Conductors smaller than #14, solid copper or stranded.
2. Purple or pink wire is the preferred color for the load side of switches. (Switch leg)
3. Standard electrical system phase colors:
   a. Color code wires for building voltage classes as follows:
   b. 120/ 208V - 3Ø:
      i. ØA – Black
      ii. ØB – Red
      iii. ØC – Blue
      iv. Neutral – White
      v. Ground – Green
   c. 277/ 480V - 3Ø:
      i. ØA – Brown
      ii. ØB – Orange
      iii. ØC – Yellow
      iv. Neutral – Gray
      v. Ground – Green

END OF SECTION 26 05 00

26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for grounding and bonding for electrical systems. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXECUTION

A. Grounding System:
   1. Provide separate grounding conductor in all raceways.
   2. Provide separate grounding jumpers from grounding screw of all receptacle devices to metallic box in which it is mounted. Jumpers may be attached to the box with a separate grounding screw. No ground clip devices are allowed.
   3. Provide separate bonding conductor in all runs to exterior lighting standards; i.e. post lights, signs, etc.
   4. All conductors used for grounding and bonding purpose shall be copper bare or insulated green only.
   5. Provide a separate grounding jumper for all dielectric unions in a freshwater system of the same size as main service ground.
   6. Neutral/ground bonding point shall be done within transformers for secondary distribution systems.

END OF SECTION 26 05 26

26 12 00 – MEDIUM VOLTAGE TRANSFORMERS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for medium voltage transformers. Additional requirements may be included within specific agreements or other contracting documents.

1.03 REGULATORY REQUIREMENTS
- A. Comply with US Department of Energy's Candidate Standard Level three (CSL-3).
- B. Comply with IEEE-519.
- C. Exceed National Electric Code related requirements.
- D. Exceed NEMA TP-1.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
- A. Powersmiths preferred.

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Provide built-in surge suppression and enhanced energy efficient harmonic cancellation.
- B. Provide twenty-five (25) year warranty.

END OF SECTION 26 12 00

26 24 00 – PANELBOARDS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for panelboards. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 TRANSFORMERS

A. Transformers shall be high efficiency Energy Star. PowerSmith to be approved. Sound levels shall not exceed level listed by ANSI-C89. Transformers to be mounted with additional isolation pads and electrical connections made with flexible conduit

PART 3 – EXECUTION

3.01 INSTALLATION

A. Main Distribution Center shall be installed on a four (4) inch housekeeping curb, wall mounted, with a maximum height of ninety (90) inches to the top of the equipment from finished floor, level and plumb.
B. Install nameplates identifying main distribution center, AIC rating, voltage, amps, phase, all branch loads and main devices.
C. Provide locks with two (2) keys furnished per lock. All panels keyed alike.
D. Door-in-door type front panel construction with nameplate mounted on front of panel.
E. Install nameplates identifying main distribution center, AIC rating, voltage, amps, phase, all branch loads and main devices.
F. Furnish typewritten directory boards to identify each circuit. Note spare circuits on directory cards in pencil.
G. Label each breaker within a panel as to type of circuit and area served with room numbers.
H. Locate in a dedicated lockable room.
I. Main Distribution Switchboard/Panelboards: Copper or tin-plated aluminum bus bars. Prefer Square D or approved equal by Owner.
J. Safety Switches: Heavy-duty type fusible or nonfusible, NEMA rating for environment installed. Prefer Square D or approved equal.
K. Electrical services to include twenty-five percent (25%) spare capacity for future.
L. Provide twenty-five percent (25%) spare capacity and space in all branch circuit panels.
M. Label all spare conduits on each end as to where it originates and terminates. Install pull string in each empty conduit.

END OF SECTION 26 24 00

26 32 00 – PACKAGED GENERATOR ASSEMBLIES

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for packaged generator assemblies. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 32 00

26 50 00 – LIGHTING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for lighting. Additional requirements may be included within specific agreements or other contracting documents.

1.03 REGULATORY REQUIREMENTS

A. Indoor Lighting:
   1. LED lights should be used in the interior of a building with a temperature of three thousand-five hundred (3500) Kelvin.
   2. Exit lighting as required by IBC and NFPA.
   3. Luminaire Schedule: Provide a luminaire schedule on the design documents to give the following information.
      a. Luminaire identification.
      b. Description (including ballast type).
      c. Manufacturer and catalog number.
      d. Voltage.
      e. Lamps (catalog number and type).
      f. Mounting with required recess depth.
      g. Input Watts per fixture.
   4. Stairs:
      a. Mount fixtures on walls at landings 8-feet above finished landing. No fixtures allowed above stairs. Each fixture has its own motion sensor.
   5. Consideration of fixtures should include the following.
      a. Durability: Choose fixtures that will last for many years and take the abuse of people.
      b. Practical: Choose fixtures that can be maintained easily and parts available for years.
         i. Choose fixtures that will be easy to clean and will keep bugs, paper, pencils, etc. out.
      c. Standardize: Choose fixtures with standard lamps and try to reduce the number of different lamps the Owner has to stock.
      d. Fixtures that require a T5 bulb are not allowed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 26 50 00

26 56 29 – SITE LIGHTING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for site lighting. Additional requirements may be included within specific agreements or other contracting documents.

1.03 REGULATORY REQUIREMENTS

A. Area Light Control
   1. Provide manual override in a convenient location for checking of exterior fixtures by City Electrician during daytime. (Location to be approved by City Electrical Department.)

B. Exterior Lighting
   1. All exterior lighting must comply with City of Fort Collins criteria.
   2. Building and parking lighting shall be pole mounted. Thirty (30) foot maximum, twelve (12) foot minimum pole height from finished grade. Install light poles on minimum twenty-four (24) inches high concrete pedestals in landscaped areas, and thirty-six (36) inch concrete pedestal in parking lots.
   3. Exterior Lamps and Ballasts
      a. All complete building replacement of exterior fixtures shall be (mention minor amendment process) High Pressure Sodium or LED (with a temperature of three thousand (3,000) Kelvin max) approved by Owner.
      b. Remodel projects shall try to match existing exterior LED fixtures if possible or Owner approved.
      c. Consider products with adaptive controls like dimmers, timers, and motion sensors.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Anchor properly.

END OF SECTION 26 56 29

26 57 00 – PROGRAMMABLE LIGHTING CONTROL SYSTEM

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for programmable lighting control systems. Additional requirements may be included within specific agreements or other contracting documents.
- B. In general the system shall control all building lighting.
- C. Lighting control system shall have programmable override switches. (The number and location of override switches to be determined in the design process) The override switches shall be capable of turning lights on/off that are turned on/off by a photocell. (Previous Lighting Control System specs/systems used in the City are available).
- D. Would prefer standalone controls wherever possible.

1.03 SUBMITTALS REQUIRED
- A. Submit shop drawings on programmable lighting controller & components for approval.

1.04 QUALITY ASSURANCE
- A. System Support:
  1. Factory-authorized technician or factory-authorized service representative shall be available for onsite training as well as telephone support.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION
- A. Program time clock functions according to Owner desired settings.
- B. Demonstration
  1. Provide a factory-authorized technician or factory-authorized service representative to train City Electrical Department personnel as specified below.
     a. Troubleshooting, servicing, adjusting, and preventive maintenance.
     b. Programming of the lighting control system.

END OF SECTION 26 57 00

DIVISION 27: Communications

27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for communications. Additional requirements may be included within specific agreements or other contracting documents.

B. Division 27: Communications work shall be coordinated with the City of Fort Collins Information Technology Department.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 27 05 00

DIVISION 28: Electronic Safety and Security

28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for electronic safety and security. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Provide diagrams on how the system is installed.

1.04 QUALITY ASSURANCE

A. All design and material shall be subject to inspection and approval by Owner before any system is to be installed. Provide all labor, material and inspections for a fully functional System.

B. In remodeled/addition, match existing systems or replace with new system if existing system is not expandable to meet needs.

C. Owner, the City of Fort Collins Information Technology department, and the City of Fort Collins Emergency Preparedness & Security department shall be coordinated with for all Division 28: Electronic Safety & Security scope.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Coordinate with the City of Fort Collins Emergency Preparedness & Security department for the current list of approved manufacturers.

PART 3 – EXECUTION

3.01 EXECUTION

A. Conduits shall be in-wall or above ceiling type. Run all conduits and wiring above the ceiling to terminate with proper fittings in security panel or other proper existing security system device.

B. All inspections and testing of system shall include prior notification of Owner.

END OF SECTION 28 05 00

28 13 53 – ACCESS SYSTEMS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for access systems. Additional requirements may be included within specific agreements or other contracting documents.

B. Coordination between door hardware access control hardware to be planned and managed with the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wiring: All installation must be verified with the specific manufacturer.

1. All wiring is to be plenum rated.
2. All door readers are to be wired with a minimum of six (6) conductor eighteen (18) gauge stranded shielded wire.
3. All door strikes are to be wired with a minimum of two (2) conductor eighteen (18) gauge stranded wire.
4. All keypads are to be wired with a minimum of six (6) conductor eighteen (18) gauge stranded wire.
5. Any access device not specifically mentioned will be wired with a minimum of four (4) conductor eighteen (18) gauge stranded wire.
6. All devices will be “home run” from the control panel to the field device.
7. All wiring is to be clearly labeled with the name of the device that is serviced. Each label shall be permanently affixed to the wire.
8. Wire numbers or color-coded wire markings or writing on the wire will not be accepted.
9. All access system wiring color coding (i.e. individual conductors) will be consistent throughout the entire security installation.
10. Ensure that all wiring is run during the pre-wire phase of the building construction. All access field equipment should be installed and tested before the district final inspection is conducted.
11. All electric panic devices shall be wired with two (2) conductor twelve (12) gauge stranded wire from power supply to device.
12. Proximity card readers shall be installed at fifty-four (54) inches AFF unless change is approved by Owner.
13. Card reader location shall be coordinated with location of any automatic door opener controls (handicapped buttons). Final layout must be approved by Owner.
14. Card readers shall be installed flush to wall when possible.
15. Installer must be Continental Controls certified.

END OF SECTION 28 13 53

28 23 00 – VIDEO SURVEILLANCE

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for video surveillance. Additional requirements may be included within specific agreements or other contracting documents.

B. Provide all labor, material, and inspections as required for a fully functional closed circuit television system.

1.03 SUBMITTALS REQUIRED

A. Submittals on the listed equipment are required. Consult with Owner for details.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Wiring: All installation must be verified with the specific manufacturer.
   1. All wire is to be plenum rated.
   2. All cameras are to be wired with Cat6 network wire.
   3. Separate control wire and/or heater-blower wiring may be required
   4. All camera power cables five hundred (500) feet or less will be wired with eighteen (18) gauge two (2) conductor wire.
   5. All camera power cables over five hundred (500) feet will be wired with sixteen (16) gauge two (2) conductor wire.
   6. All Cat6 cable ends will have RJ45 type connector.
   7. All devices will be “home run” from the control panel to the field devices.
   8. All wiring will be run without any splices, junctions, or break of any kind in the wire.
   9. All wiring will be clearly labeled with the name of the device that it services. Each label shall be permanently affixed to the wire.
   10. Wire numbers or color-coded wire markings or writing on the wire will not be accepted.
   11. Ensure that all wiring is run during the pre-wire phase of the building construction. All access field equipment should be installed and tested before final inspection is conducted.
   12. All camera field equipment shall be installed and tested before final inspection is completed.
   13. All PTZ camera power cables will be wired with a minimum sixteen (16) gauge two (2) conductor wire.

B. Camera Installation: To be determined per project.

C. Recording Device: To be determined per project.

END OF SECTION 28 23 00

DIVISION 31: Earthwork

31 05 00 – COMMON WORK RESULTS FOR EARTHWORK

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENT

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for earthwork.
   1. Clearing, grubbing and site preparation.
   2. Removal and disposal of debris.
   3. Handling, storage, transportation, and disposal of excavated material.
   4. Sheeting, shoring, bracing and protection work.
   5. Pumping and dewatering as required or necessary.
   6. Backfilling.
   7. Pipe embedment.
   8. Construction of fills and embankments.
   9. Excavation for buildings and structures.
   10. Trench stabilization.
   11. Final grading.
   12. Slope stabilization.
   13. Erosion control.
   14. Appurtenant work.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Submit under provisions of Division 1 specifications.

B. Product Data.

C. Test Reports.

D. Stormwater.

1.04 QUALITY ASSURANCE

A. All imported material to be free of hazardous and organic wastes, “clean” as defined by EPA, and approved for its intended use by the Owner or Project Geotechnical Engineer.

1.05 REGULATORY REQUIREMENTS

A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling.

B. Protect work from erosion or other similar types of damage until the project has been completed. Maintain and leave protection in place until permanent erosion control and soil stabilization is effective.

C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is thirty-five (35) degrees Fahrenheit and rising.

D. Do not use frozen materials, snow, or ice in any backfill or fill area.

E. Do not backfill or construct fill on frozen surfaces.

F. Protect excavated material from becoming frozen.

G. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities
H. Provide temporary bridges for roadways, walkways, driveways, etc. as construction conditions warrant.

PART 2 – PRODUCTS

2.01 GENERAL
A. Soil materials, whether from sources on or off the site must be approved by the soils engineer as suitable for intended use and specifically for required location or purpose.

2.02 CLASSIFICATION OF EXCAVATED MATERIALS
A. Remove and handle all excavated materials regardless of its type, character, composition, condition, or depth.
B. Transport and properly dispose of any rubble and waste materials found in excavation off the Owner's property.

2.03 FILLS AND EMBANKMENTS
A. To the max extent practical use excess earth from onsite excavation for fills and embankments.
B. Obtain additional material from offsite as necessary. Imported fill material must be acceptable to the Owner and Engineer or Geotechnical Engineer.
C. Material must be free from rocks or stones larger than twelve (12) inches in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials.
D. Fill and embankment material must be acceptable to Engineer.
E. No rocks or stones larger than six (6) inches in upper eighteen (18) inches of fill or embankment.
F. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

2.04 IMPORTED STRUCTURAL FILL
A. Limits extend a minimum of two (2) feet beyond the back of proposed pavement, slabs, curbs and walks.
B. Imported structural fill, such as a minus one-half (½) inch CDOT Class 7 Aggregate Road Base, conforming to the following:
   1. Gradation: One (1) inch – One hundred percent (100%) passing (percent finer by weight ASTM C136), No. 8 Sieve – Two thousand-eighty-five percent (2085%) passing, and No. 200 Sieve – Twenty percent (20%) maximum.
   2. Liquid Limit: 35 (max), Plasticity Index: Fifteen (15) maximum, R- Value: Fifty (50) minimum.

2.05 IMPORTED FILL
A. Imported fill conforming to the following:
   1. Gradation (percent finer by weight ASTM C136): Three (3) inches – One hundred percent (100%) passing, No. 4 Sieve – Fifty thousand-one hundred percent (50100%) passing, and No. 200 Sieve – Thirty-five percent (35%) passing (max).
B. Liquid Limit: Thirty-five (35) maximum, Plasticity Index: Fifteen (15) maximum, Group Index: Ten (10) maximum.

2.06 TOPSOIL
A. Topsoil is defined as friable (easily crumbled) clay loam surface soil, with high organic content, found in a depth of not less than four (4) inches below existing grade. Excavate acceptable material further to provide all topsoil necessary for project needs
B. Clean topsoil, free of plants and seed will be spread to four (4) inches minimum depth for areas of the site.
C. Dispose of grubbings, including any plant material and seeds, offsite.

D. Stockpile of all remaining topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones larger than two (2) inches in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted.

2.07 PIPE EMBEDMENT: GRADED GRAVEL

A. Washed rock: One and one-half (1½) inch minus

Sieve Size (Inch)	2	1½	1	¾	½	3/8
Percent Passing by Weight (%)	100	95-100	80-95	30-45	10-25	<1

B. Squeegee

Sieve Size (Inch)	3/8	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
Percent Passing by Weight (%)	100	85-100	30-70	5-40	0-15	0-10	0-5	<1

2.08 COMPACTED TRENCH BACKFILL

A. Job excavated material finely divided, free of debris, organic material, and stones larger than three (3) inches in greatest dimension without masses of moist, stiff clay, or topsoil.

2.09 TRENCH COVER

A. Free of brush, debris and roots.
B. May contain rubble and detritus from excavation, stones and boulders if well separated and arranged not to interfere with backfill settlement.
C. In upper eighteen (18) inches no rock or rock excavated detritus, larger than six (6) inches except with specific approval of Architect/Engineer.
D. No stones larger than six (6) inches in greatest dimension within three (3) feet of top of pipe.

2.10 ACCESSORIES

A. Silt Fence Fabric: Woven polypropylene.

PART 3 – EXECUTION

3.01 PREPARATION

A. Examination
   1. Field verify the location of all underground utilities, pipelines and structures prior to excavation.
B. Performance – General
   1. Perform work in a safe and proper manner with appropriate precautions against hazard.
   2. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities.
   3. Contain all construction activity on the designated site and limits of work.
   4. Cost of restoration off site will be borne by the Contractor.
C. Preservation of Trees
   1. Protect trees left standing from permanent damage by construction operation.
   2. Tree removal and protection shall be approved by Forestry Department.
D. Preparation

1. Clear all site areas to be occupied by permanent construction of grasses, roots, brush, and other objectionable material and debris.
2. Clean and strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil.
3. Remove all waste materials from site and dispose.
4. Remove debris, all trees, underbrush, stumps, roots and other combustible materials from site daily and dispose of off-site; on-site burning is not permitted.

3.02 INSTALLATION

A. Topsoil
   1. Strip on-site material meeting the topsoil definition to a minimum depth of 4 inches for all areas receiving grading.
   2. At the completion of work in each area, place and grade topsoil to maintain gradient is required. Roughen surface for erosion control.

B. Dewatering
   1. Provide and maintain adequate dewatering equipment
   2. (including power supply, if necessary) to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the work.
   3. Keep each excavation dry during subgrade preparation and
   4. continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
   5. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least twelve (12) inches below the bottom of the excavation.
   6. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property.
   7. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup.
   8. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Obtain dewatering permit and comply with discharge requirements therein, if necessary.

C. Sheeting, Shoring, and Bracing
   1. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities
   2. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure, and to be rigid, maintaining shape and position under all circumstances.
   3. Do not pull trench sheeting before backfilling unless pipe strength is sufficient, to carry trench loads based on trench width to the back of sheeting.
   4. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe.
   5. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed.

D. Trench Stabilization
   1. Thoroughly compact and consolidate subgrade for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities.

2. Remove all mud and muck during excavation.
3. Reinforce subgrade with crushed rock or gravel if they become mucky during construction activities.
4. Finished elevation of stabilized subgrade are to be at or below subgrade elevations.
5. Allow no more than one-half (½) inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

E. Excavation For Structures
1. Excavate to elevations and dimensions within a tolerance of ±0.10 feet.
2. Soils shall be excavated to various depths below foundation elevation according to structural foundation plan.
3. The subexcavation shall be configured at a minimum side slope inclination of one (1) horizontal to one (1) vertical from the toe of the subexcavation slope. The toe of the subexcavation slope shall be no closer than five (5) feet outside the outermost edge of all concrete footings or building boundaries laterally, whichever is larger. Slope shall continue to the proposed surface grades. Remove soft or otherwise unsuitable material, and replace with suitable material in excavation.
4. Provide dewatering and temporary drainage as required to keep excavations dry.

F. Pavement Overexcavation and Subgrade Preparation
1. Excavate subgrade for drives and parking per the lines, grades, and dimensions within a tolerance of ±0.10 feet.
2. Over excavate and scarify existing soil as required under pavement areas, slabs, curbs and walks to meet the moisture and compaction specifications required.
3. Place imported structural fill per plans and compaction specification herein. Extend a minimum of two (2) feet beyond the back of proposed pavement, slabs, curbs and walks.
4. Reshape subgrade and wet as required

G. Fills and Embankments
1. Level and roll subgrade so surface materials will be compact and bond with the first layer of fill or embankment.
2. Place in horizontal layers at maximum uncompacted depth per compaction specifications herein.
3. Spread and level material deposited in piles and windrows before compacting.
4. Thoroughly compact each layer by rolling or other means acceptable to Engineer to meet the moisture and compaction specifications herein.
5. Alter compaction methods if material fails to meet specified density.
6. Where a trench passes through a fill or embankment, place and compact fill or embankment to twelve (12) inches above the top of the pipe before excavating the trench.
7. Add water and harrow, disc, blade, or otherwise work each layer to obtain the uniform moisture content and adequate compaction.

H. Compaction
1. Place backfill and fill materials in layers not more than eight (8) inches loose depth for material compacted by heavy compaction equipment, and not more than four (4) inches in loose depth for material compacted by hand-operated tampers.
2. Place backfill and fill materials evenly on all sides of structures to required elevations.
3. Place backfill and fill uniformly along the full length of each structure as described herein.
4. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 698 as follows:
    a. For over excavation areas under paving and structures, compact each layer of backfill or fill.

b. For fill under site features and concrete and asphalt pavements not within the public right-of-way, compact at ninety-five percent (95%) of maximum density within minus two percent (-2%) to plus two percent (+2%) of optimum moisture content. Compact in right-of-way to municipal standards and specifications.
c. At utility trench backfill, compact each layer of backfill at ninety-five percent (95%) maximum dry density to within minus two percent (-2%) to plus two percent (+2%) of optimum moisture content.
d. For fill under lawn or unpaved areas, scarify and compact the top six (6) inches below subgrade and each layer of backfill or fill material to ninety percent (90%) maximum dry density to within minus two percent (-2%) to plus two percent (+2%) of optimum moisture content.
e. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.
f. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

I. Borrow or Spoil Area
1. Obtain suitable material required to complete fill and embankments from approved offsite borrow area.
2. The location, size, shape, depth, drainage, and surfacing of borrow or spoil pits shall be acceptable to Owner of borrow area.
3. Make all areas regular in shape with graded and surfaced side and bottom slopes when completed.
4. Cut side slopes not steeper than one to one (1:1) and uniform for the entire length of any one (1) side
5. Final grade disturbed areas of borrow to uniform slope, four to one (4:1) slope or flatter.
6. Use material free of debris and deleterious material.

J. Blasting
1. Blasting or other use of explosives is not permitted.

K. Trench Excavation
1. Establish alignment and grade or elevation from offset stakes.
2. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations.
3. Comply with pipe specification sections regarding vertical and horizontal alignment and max joint deflection.
4. Excavate trenches to provide a minimum depth of backfill cover over the top of pipe as follows. Coordinate depth of cover with utility owners. Increase depth as required by utility owner and at crossings.
   a. 1.5 feet for drainage piping.
   b. 2.5 feet for gas piping.
   c. 3.0 feet in paved or graded streets where surface grades are fixed.
   d. 5.0 feet for sanitary sewer and water piping.
   e. 2.5 feet for electric conduit.
   f. Increase depth as required at vertical curves and for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades.
5. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation.

6. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than two hundred (200) feet.
7. Excavate trenches by open cut from the surface.
8. Limiting trench widths:
    a. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment.
    b. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than one (1) foot above the top of the pipe.
    c. Stipulated minimum clearances are minimum clear distances, not minimum average distances.
    d. Max trench width from six (6) inches above the top to trench bottom of the installed pipe:
    e. Pipe O.D. plus twenty-four (24) inches.
    f. Limiting trench widths and permissible clearances from six (6) inches above top of pipe to trench bottom for installed pressure and non-pressure piping.

Pipe Size (Inch)	Minimum Trench Width	Maximum Trench Width
3	1’6”	2’6”
4	1’6”	2’6”
6	1’6”	2’6”
8	1’8”	2’8”
10	2’0”	3’0”
12	2’0”	3’0”
16	2’8”	3’8”
18	3’0”	4’0”
24	3’6”	4’6”
36	4’0”	5’0”

    g. If the width of the lower portion of the trench exceeds the max permitted, provide pipe of adequate strength, special pipe embedment, or arch concrete encasement as required by loading conditions and as determined by Engineer.

L. Mechanical Excavation
1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas.
2. Use mechanical equipment of a type, design, and construction and operated so that:
    a. Rough trench bottom elevation can be controlled.
    b. Uniform trench widths and vertical sidewalls are obtained from one (1) foot above the top of the installed pipe to the bottom of the trench.

c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls.
3. Do not undercut trench sidewalls.
4. Re-compact trench bottom disturbed by bucket teeth prior to placement of embedment material.
5. Except as otherwise required, excavate trenches below the underside of pipes for installation of granular embedment pipe foundation material.
6. Trench bottoms for six (6) inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support (between bell holes or end joints) of the installed pipe.
7. Excavate to such depth below grade as Architect/Engineer directs and bring the trench bottom to grade with such material as Architect/Engineer may direct.
8. Provide concrete, or other foundations made necessary by unstable soil.
9. Excavate to provide adequate clearance for tools and methods of pipe installation.
10. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined.
11. Cuts in existing surface construction:
    a. No larger than necessary to provide adequate working space.
        i. Cut a clean groove not less than one and one-half (1½) inch deep along each side of trench or around perimeter of excavation area.
        ii. Remove pavement and base pavement to provide shoulder not less than six (6) feet wide between cut edge and top edge of trench.
        iii. Do not undercut trenches, resulting in bottom trench width greater than top widths.
        iv. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation.
        v. Remove pavement for connections to existing lines or structures only to the extent required for the installation, or as determined by Architect/Engineer.
        vi. Where the trench crosses the drives, walks, curbs, or other surface construction, remove and replace the surface construction between saw cuts as specified for pavement.

M. Pipe Embedment
1. Embed pipes above and below the bottom of pipe.
2. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe and to hold the pipe in proper position and alignment during subsequent operations.
4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent lateral displacement.
5. Granular embedment compact by slicing with shovel or vibrating.
    a. Maximum uncompacted thickness of layers: Six (6) inches.
6. Compacted embedment: Place in horizontal layers at maximum uncompacted depth per compaction specifications herein. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

N. Trench Backfill
1. Compacted backfill:
    a. For full depth of trench above embedment.

b. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures.
c. In street or highway shoulders.
d. In established sodded areas.
e. Beneath fills and embankments.

2. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench.
3. Place job excavated materials in 8-inch maximum uncompacted thickness, uniform layers
4. Increased layer thickness may be permitted for incohesive if specified compacted density will be achieved.
5. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe.
6. Thoroughly compact each layer to meet the moisture and compaction specifications herein.
7. Graded gravel:
   a. Deposit in uniform layers of twelve (12) inches maximum uncompacted thickness.
   b. Compact with suitable vibrating roller or platform vibrator to not less than seventy percent (70%) relative density per ASTM D4253/D4254.
8. Uncompacted backfill:
   a. Compaction of backfill above pipe embedment in locations other than those specified, is required only to prevent future settlement.
   b. May be placed by any method acceptable to Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and will not result in displacement of installed pipe.
   c. Do not drop compact masses of stiff clay or other consolidated material more than five (5) feet into trench unless cushioned by two (2) feet minimum of loose backfill above pipe embedment.
9. Finish the top portion of backfill with at least four (4) inches of topsoil corresponding to, or better than, that underlying adjoining turf areas.

O. Drainage Maintenance
1. Do not backfill trenches across roadways, drives, walks or other traffic ways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the traffic way to prevent impounding water after pipe is laid.
2. Backfill so that water does not accumulate in unfilled or partially filled trenches.
3. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours.
4. Do not obstruct surface drainage any longer than necessary.
5. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic.

P. Protection of Trench Backfill
1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion.
2. Install ditch checks where the ditch grade exceeds one percent (1%).
   a. Minimum Depth: Two (2) feet below the original ditch or water course bottom for the full bottom width.
   b. Minimum Width: Eighteen (18) inches into the side slopes.
   c. Minimum Thickness: Twelve (12) inches.

Q. Disposal of Excess Excavated Materials
    1. Use excess excavated materials in fills and embankments.
    2. May dispose of up to two hundred (200) cubic yards of suitable excess excavated materials from onsite or offsite at locations on the site directed by Owner.
    3. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it.
    4. Distribute excess earth from excavations located in unimproved property directly over the pipe trench and within the pipeline right-of-way to a max depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly each way.
        a. Carefully finish material thus wasted with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point.
        b. Do not waste excess excavated material in the above manner where the trench lines cross or is within a railroad, public road, or highway right-of-way.
R. Final Grading
    1. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the elevations.
    2. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work.
    3. Grade all surfaces for effective drainage, provide a two percent (2%) minimum slope except as otherwise required.
    4. Grade and surface to maintain gradient.
S. Slope and Channel Stabilization
    1. Cover channel banks, slopes or channel thalweg (water flow-line at deepest part of the channel) with erosion control fabric mat where grade is 3H to 1V or greater.
    2. Lay fabric smoothly on surface, bury top end of each section in six (6) inch deep excavated topsoil trench. Provide six (6) inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
    3. Secure outside edges and overlaps at forty-eight (48) inch intervals with four (4) inch to six (6) inch U-shaped type pins or wooden stakes depending on ground condition.
    4. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
    5. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum six (6) inches.
    6. Maintain integrity of erosion control fabric throughout installation.
T. Settlement
    1. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed.
    2. Repair or replace within thirty (30) days after notice by Architect/Engineer or Owner.
U. Field Quality Control
    1. Provide under the provisions of General Conditions and Division 1 Specifications.
    2. Coordinate testing with Owner. Owner will provide all field testing to determine compliance of in-place and backfill materials and compaction in accordance with the specifications, and to verify design bearing capacities.
    3. Fills and Embankment
        a. Two moisture-density relationship tests, ASTM D698, on each type of fill material.
        b. One in-place compaction test for each five thousand (5,000) square feet every 1.5 feet of vertical lift of material placed.
        c. Additional in-place compaction tests at the discretion of the Owner.
    4. Pipe Embedment and Backfill

a. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material.
b. One in-place compaction test every two hundred (200) lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, ASTM D2922/D3017.
c. One (1) in-place compaction test near top of trench for trench depth of two (2) feet or less, ASTM D2922/D3017.
d. Additional in-place compaction tests at the discretion of the Owner.

5. Pavement and Structural Subgrades
a. At a minimum, two (2) moisture-density relationship tests, ASTM D698, or two (2) relative density tests, ASTM D4253/D4254, as appropriate and adequate for each type of backfill material proposed.
b. Perform tests for each footing, concrete site feature, and drainage structure subgrade. Perform tests at every fifty (50) linear feet of subgrade of foundation walls, retaining walls, and curbing, pans, drainage features, walks, etc. (or portions thereof). Perform tests every two thousand (2,000) square feet required of building slab area, exterior slabs and pavement/flatwork areas (with no less than three (3) tests). Test at subgrade and at every vertical lift of backfill materials placed.
c. Additional in-place compaction tests at the discretion of the Owner.

V. Building Pad Reshaping
1. Building Pad Approval
a. Overlot grading has taken place prior to the award of this Contract. Responsible for discing and reshaping the building pad area for those locations which have been damaged by freezing temperatures, frost, rain, accumulated water or construction activities.
b. Certify subgrade elevations and compaction for the building pad.
c. If Architect/Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material.
d. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

END OF SECTION 31 05 00

31 10 00 – SITE CLEARING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes, but is not limited to, administrative and procedural requirements for site clearing.
  1. Removal of surface debris.
  2. Removal of paving and curbs.
  3. Removal of trees, shrubs, and other plant life.
- B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE
- A. Coordinate clearing work with Utility Companies. Comply with their requirements.

1.04 DELIVERY, STORAGE, AND HANDLING
- A. Environmental Requirements
  1. Observe environmental precautions based on conditions.
  2. Conform to applicable ordinances and codes for dust and erosion control, disposal of debris, use of herbicides, and other environmental requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION
- A. Verify that existing plant life designated to remain is tagged or identified.

3.02 CLEANING AND PROTECTION
- A. Protection
  1. Locate, identify, and protect from damage utilities that remain.
  2. Protect existing trees, plant growth, and features.
  3. Protect benchmarks, and survey control joints from damage or displacement.
- B. Clearing
  1. Clear areas required for access to site and execution of Work.
  2. Clear undergrowth and deadwood, without disturbing subsoil.
  3. Apply herbicide to remaining stumps and vegetation to inhibit growth.
- C. Removal
  1. Remove trees and shrubs within marked areas. Remove stumps and root systems to depth of 3 feet.
  2. Remove debris, rock, and extracted plant life from site.
  3. Remove paving and curbs as required to connect to existing.
  4. Remove debris from site clearing operations from the site.

END OF SECTION 31 10 00

31 23 00 – EXCAVATION AND FILL

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for excavation and fill.
   1. Excavation and trenching including, but not limited to:
      a. Drainage.
      b. Preparation of subgrades.
      c. Pipe bedding.
      d. Backfilling.
      e. Compacting.
      f. Finish grading for underground pipelines and appurtenances.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 QUALITY ASSURANCE

A. "CDOT" refers to Colorado Department of Transportation designations in their "Standard Specifications for Road and Bridge Construction."
   1. When CDOT is referenced herein.

1.04 SCHEDULING

A. Right-of-Way
   1. In developed areas haul and stockpile excess material or erect suitable bulkheads to prevent deposition of excavated material where right-of-way or easements are not adequate to stockpile all excavated material without depositing it on private property.

B. Drainage and Groundwater.
   1. Maintain excavations and trenches free from water during construction.
   2. Remove water encountered in the trench to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.
   3. Divert surface runoff and use sumps, gravel blankets, well points, drain lines or other means necessary to accomplish the above.
   4. Maintain the excavation or trench free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
   5. Uncontaminated groundwater shall be prevented from entering into previously constructed pipe. Groundwater contaminated by sanitary waste shall be discharged into the sanitary sewer.
   6. The pipe under construction shall not be used for dewatering.

C. Sequencing
   1. Perform pipeline installation within fifty (50) linear feet of trench excavation.
   2. Perform trench backfill within fifty (50) linear feet of pipe installation.
   3. Perform clean-up within two hundred (200) linear feet of trench excavation.
   4. Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening is to be minimized.

5. Maintain access to private residence and businesses.

D. Underground Obstructions
   1. Locate and verify all underground utilities and obstructions.
   2. Maintain, protect and support by shoring, bracing or other means existing utilities, appurtenances and structures.
   3. Take such protective measures as the utilities may direct where protection, alternations or moving of the utilities is required.

E. Weather
   1. Do not backfill or construct fills or embankments during freezing weather.
   2. Do not place backfill, fill or embankment on frozen surfaces.
   3. Do not place frozen materials, snow or ice in backfill, fill or embankments.
   4. Do not deposit, tamp, roll or otherwise mechanically compact backfill in water.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage
   1. Provide adequate and orderly storage of excavated material adjacent to Work.
   2. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks or trench or excavation to avoid overloading and to prevent slides or cave-ins.
   3. Do not stockpile excavated materials against existing structures, Work, or appurtenances.
   4. Excess excavated material will not remain on job site for more than one (1) month.

1.06 REGULATORY REQUIREMENTS

A. Maintenance and Correction
   1. Scarify surface, reshape, and compact to required density completed or partially completed areas of work disturbed by subsequent construction operations or by adverse weather.
   2. Maintain and correct backfill, fill and embankment settlement and make necessary repairs to pavement structures, seeding and sodding which may be damaged as a result of settlement for period of one (1) year after Substantial Completion and acceptance of the Work.

PART 2 – PRODUCTS

2.01 GENERAL

A. All material shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, broken asphalt and concrete, and any other material that is not suitable in the opinion of the Town.

B. If job excavated material is not sufficient or suitable, suitable material shall be imported. All imported material shall have a liquid limit not greater than thirty (30) and a plasticity index not greater than six (6).

2.02 STABILIZATION MATERIALS

A. Top six (6) inches of pipe subgrade – If the existing soil in the trench bottom is judged to be unsuitable the top six (6) inches of the pipe subgrade shall be removed and replaced with a stabilization material.
   1. Stabilization material is crusher-run rock, conforming to ASTM D448, size #357.

Size	2½”	2”	1”	½”	#4
Percent Passing	100	95-100	35-70	10-30	0-5

   2. Geotextile: CDOT, Section 712.08, Class A Table 712-2.

3. Subgrade below top six (6) inches: Same as top six (6) inches except that broken concrete and rock may be included in sizes permitting compaction without discernible voids.
    a. Alternative materials for stabilization of sub-grade will be considered for use as approved by the Owner and Engineer.

2.03 BEDDING MATERIALS

A. Definition: Materials placed from the subgrade to an elevation twelve (12) inches above the top of pipe.
B. Granular material:
    1. Angular crushed rock, conforming to CDOT #67.

Size	1”	¾”	3/8”	#4	#8
Percent Passing	100	90-100	20-55	0-10	0-5

    2. Or, well-graded angular crushed rock: ninety-five percent (95%) passing a one (1) inch sieve and not more than five percent (5%) passing a No. 4 sieve.
C. Concrete:
    1. Compressive strength: Four thousand (4000) psi at twenty-eight (28) days minimum.
    2. Class A concrete, reference Colorado Department of Transportation, Division of Highways, State of Colorado "Standard Specifications for Road and Bridge Construction".
D. Barrier Material:
    1. Soil Classification:
        a. GC - clayey gravels, gravel-sand-clay mixtures.
        b. SC - clayey sands, sand-clay mixtures.
        c. CL - inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, clean clays.
        d. Material shall not be lumpy or hard but shall be finely divided, suitable, and free from stones.
E. Bedding material for service lines less than four (4) inches in diameter shall be sands or silts and clays meeting the Unified Soil Classification types ML or CL. Material shall not be lumpy or hard but shall be finely divided, suitable, and free from stones greater than one-half (½) inch in its largest dimension.

2.04 TRENCH BACKFILL MATERIAL

A. Trench backfill material shall be placed from a point twelve (12) inches above the pipe to six (6) inches below the ground surface, to bottom of topsoil layer, or to the bottom of the pavement subgrade, whichever is applicable.
B. Trench backfill material shall be soil free from any rocks or stones which are larger than six (6) inches, in any dimension.
    1. Rocks or stones which are larger than three (3) inches, in any dimension, shall not be placed within one foot of pavement subgrade, or within one (1) foot of the finished surface of unpaved areas.
    2. Material shall not be lumpy or hard but shall be finely divided.

PART 3 – EXECUTION

3.01 PREPARATION

A. Topsoiling: Remove a minimum of six (6) inches of topsoil and stockpile topsoil away from areas to be disturbed by construction. Keep topsoil segregated from non-organic excavation materials and debris.

3.02 INSTALLATION

A. Trenching
   1. Avoid removal of obstructions.
   2. Do not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, or other property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.
   3. Use mechanical equipment so designed and operated that the rough trench excavation bottom elevation can be controlled with uniform trench widths and vertical sidewalls from an elevation one foot above the top of the installed pipe to the bottom of the trench, and trench alignment sufficiently accurate to permit pipe to be aligned properly between the pipe and sidewalls of the trench. Do not undercut the trench sidewall to obtain clearance.
   4. Excavation in rock.
      a. Over excavate a minimum of six (6) inches below the bottom of the pipe.
      b. Backfill with granular material.
   5. Preparation of Trench Bottom.
      a. Grade trench bottoms uniformly to provide clearance for each section of pipe.
      b. Remove loose materials, water and foreign objects.
      c. Provide firm subgrade suitable for application of bedding material.
      d. Wherever unstable material is encountered in the bottom of the trench, overexcavate such material to a depth suitable for construction of a stable subgrade. Backfill overdepth with stabilization material and compact. A layer of geotextile fabric shall be placed between the stabilization material and the bedding material.
   6. Stockpiling Excavated Materials.
      a. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks of the trench to avoid overloading and to prevent slides or cave-ins.
      b. Remove and dispose of excess excavated materials not suitable or not required for backfilling.
      c. Do not stockpile excavated material against existing structures or appurtenances.
      d. Excess excavated material will not remain on job site for more than one (1) month.
   7. Limiting Trench Widths.
      a. Trenches shall be excavated to a width necessary to provide a twelve (12) inch minimum working space between the pipe and the trench walls for proper pipe installation, joining, and bedding.
      b. The maximum trench width at an elevation twelve (12) inches above the top of the installed pipe, shall be two (2) barrel diameters of the pipe or thirty-two (32) inches whichever is greater.
         i. If the width of the trench, twelve (12) inches above the top of the installed pipe, exceeds the maximum allowable trench width, a higher strength pipe or special pipe bedding shall be provided, as required by soil loading conditions and as determined by the Owner.

B. Pipe Bedding
   1. Bedding classes: Provide higher class bedding where unexpected trench conditions are encountered.
   2. Placement and Compaction.

a. Distribute and grade bedding material to provide uniform and continuous support beneath the pipe at all points between bells and pipe joints.
b. Deposit bedding material and compact uniformly and simultaneously on each side of the pipe to prevent lateral displacement.
c. Compact granular bedding material by vibrating, slicing with a shovel, or bent teebar.

3. Ground Water Barriers.
   a. To impede passage of water through bedding material, construct a ground water barrier the full trench width, approximately 4 feet long, and from the bottom of all Granular Material to top of Granular Material.
   b. Space:
      i. Approximately ten (10) feet downstream of each manhole for sanitary sewers and storm drains.
      ii. Every four hundred (400) feet on water lines and force main.
      iii. Place a ground water barrier twenty (20) feet downstream of the edge of all drainage ways, streams and water courses.
4. Over Depth Excavation.
   a. Restore over excavated subgrades to proper elevation with stabilization material or granular material.

C. Backfilling and Compaction
1. Backfill trench promptly after completion of pipe bedding.
2. Deposit backfill material in uniform layers not exceeding eight inches in uncompacted thickness. Increased layer thickness may be acceptable provided it is demonstrated that the specified compacted density will be obtained.
3. Use methods and equipment appropriate for the backfill material. Do not use equipment or methods that will transmit damaging shocks to the pipe.
   a. Do not perform compaction by jetting or water settling.
4. Import material for trench backfill if compaction cannot be obtained with job excavated material, when specifically required by these Contract Documents, or required by jurisdictional authorities.
5. Rock and bedrock encountered in the excavation shall be separated from other excavated material and disposed of.
6. Topsoiling: Replace topsoil after construction and grading to the depth of stripping over all areas disturbed by construction operations and which will not receive other surface treatment.
7. Obtaining a site for disposal of excavated rock and bedrock material, excess excavated materials, and material not suitable for backfilling is necessary. If excavated materials are disposed on private property, written permission shall be obtained from the property owner and a copy given to Owner.

D. Field Quality
1. Field Compaction Control.
   a. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with:
      i. ASTM D2922 (AASHTO T238) - Tests for Density of Soil and Soil - Aggregate In-
      ii. Place by Nuclear Methods, or
      iii. ASTM D1556 (AASHTO T191) - Tests for Density of Soil In-Place by the Sand
      iv. Cone Method, or
      v. ASTM D2167 (AASHTO T205) - Tests for Density of Soil In-Place by Rubber Balloon Method.

2. Compaction shall be to the following minimum densities.
    a. Subgrade under footings or foundations: One hundred percent (100%).
    b. Barrier material: Ninety-five percent (95%).
    c. Pipe bedding.
        i. Compacted granular material: Eighty percent (80%) (ASTM D4253, D4254).
        ii. Barrier material: Ninety-five percent (95%).
    d. Trench backfill.
        i. Within right of way and under areas of permanent surface improvements: Ninety-five percent (95%).
        ii. Under footings, foundations or structures: Ninety-five percent (95%).
        iii. Seeded areas: Eighty-eight percent (88%).
        iv. All other locations: Ninety-five percent (95%).
        v. Do not compact topsoil.
    e. Where granular materials are used in lieu of cohesive soils reduce the above percentages by fifteen percent (15%) to arrive at the relative density and ASTM D4253 and D4254 shall apply.
3. Moisture Content
    a. All compacted backfill shall be within two percent (±2%) of the optimum moisture content of the soil as determined by ASTM D698.
    b. Water shall be added to the material, or the material shall be harrowed, disced, bladed, or otherwise worked to ensure a uniform moisture content.

E. Compaction Test Failure
1. Recompact the material to the required state of compaction. In cases where there is a failure to achieve the required state of compaction, the Owner may require that the backfill be removed and recompacted or replaced.
2. A hydrostatic retest shall be required on water lines after recompaction if the hydrostatic testing had been performed prior to recompaction.
    a. Testing shall be performed between valves on both sides of the area of recompaction.
3. A retest of wastewater lines shall be required after recompaction if the testing has been performed prior to recompaction.
    a. Testing shall be performed between manholes on both sides of area of recompaction.

END OF SECTION 31 23 00

DIVISION 32: Exterior Improvements

32 05 00 – COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for common work results for exterior improvements. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 GENERAL

A. Source materials and products regionally whenever possible. Submit documentation of manufacturing locations and origins of materials for products manufactured and/or sourced from within five hundred (500) miles of the building site.

B. Use recycled and/or rapidly renewable materials whenever possible. Submit invoices and listings of recycled and/or rapidly renewable materials are used.

1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
2. Select products with the highest recycled or rapidly renewable content that is readily available.

C. Use salvaged and recovered products where feasible. Submit documentation showing the origins of any salvaged products.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 32 05 00

32 10 00 – PAVING, SIDEWALKS, AND CURBING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for paving, sidewalks, and curbing.
   1. Paving requirements.
   2. Construction of curbs, curbs with gutters, cross-pan sections, and sidewalks.
   3. Pavement markings.

B. Additional requirements may be included within specific agreements or other contracting documents.

C. Refer to City of Fort Collins Streets Department specifications for paving.

D. Snowplow access required to all paved areas, including sidewalks.

E. Curb Configuration: Vertical with full cut at drives and ramps. Invert curbs preferred. Roll curb on a case-by-case basis.

F. Drainage shall not cross major pedestrian paths.

G. Specify the least amount of asphaltic concrete paving as possible. Utilize light colored/high albedo materials with a high SRI instead of asphalt when feasible.

H. Where feasible, use rubberized asphalt. Preference shall be given to mixes using wet or dry crumb rubber materials. Crumb rubber shall be one hundred percent (100%) post-consumer recycled tires.

I. Where feasible, incorporate crushed concrete or blast furnace slag complying with ASTM D692; recycled porcelain or other non-traditional aggregate material complying with ASTM D6155; or onsite demolition debris. Reduce use of Portland cement by using less cement or substituting a percentage of material with fly ash, slag cement or other recycled material. Provide appropriate documentation.

J. Consider porous pavement systems such as precast concrete pavers, monolithic concrete porous pavement, or recycled plastic pavers to reduce site impervious cover.

1.03 SUBMITTALS REQUIRED

A. Product Data.

B. Samples.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Installer (Pavement Marking) must be regularly engaged in this type of work and with proper equipment for striping a project of this size. Installer shall have done five (5) jobs of similar size and scope in the prior five (5) years.

B. Standards (Pavement Marking)
   1. Comply with the Larimer County Urban Area Street Standards, latest edition.
   2. Comply with the Manual for Uniform Traffic Control Devices (MUTCD), latest edition.

C. Warranty
   1. Bituminous (Asphalt) Pavement: Two (2) year labor and material warranty covering creeping, shoring, cracking, settling, and ponding.

PART 2 – PRODUCTS

2.01 GENERAL

A. Concrete paving required at the following locations:
   1. Trash pick-up areas.
   2. Loading dock areas.
   3. Entrance walks.
B. Concrete paving preferred at the following locations, where budget allows:
   1. Bus Stop/Terminals.
   2. Parking areas.
   3. Dumpster pads.
   4. Service vehicle parking areas.
C. Asphaltic pavement preferred elsewhere. Thickness to match use.
D. Walks: Walks that are driven on should be a minimum six (6) inches deep and eight (8) feet wide where applicable.
E. Drain Pans: Four (4) foot drain pans are recommended. Concrete drain pans within asphalt pavement are preferred.
F. Wheelstops:
   1. May be used depending on location.
   2. Permanent curbs preferred.
G. Pavement Marking
   1. Materials:
      a. Paint markings shall not fade, crack, flake, or peel within the warranty period.
      b. Yellow color, or white markings/red curb for fire lanes, meeting requirements of Section 708.05, "Pavement Marking Paint" of the Standard Specifications for Road and Bridge Construction, 1986, Colorado Department of Highways.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Execution
   1. Herbicide:
      a. In instances where the base is replaced, herbicide is required.
   2. Asphalt Reinforcing Mesh: Two (2) inch minimum overlay.
   3. Asphalt Edge Detail (Mandatory): Curb or twelve (12) inch wide reinforced concrete to depth of base course.
   4. Concrete Reinforcing: Maintain welded wire fabric between center and bottom one-quarter (¼) of slab. Synthetic fibers may be used when called for.
   5. Concrete Finish: Medium broom texture perpendicular to main traffic flow.
B. Field Quality Control
   1. Notify Owner at least twenty-four (24) hours in advance of the following:
      a. Start of excavation, backfilling and compacting operations.
      b. Staking of grades/elevations.
      c. Subgrade placement.
      d. Base course placement.
      e. Prime coat.
      f. Wearing surface placement.
C. Subgrade
   1. Scarify to a depth of six (6) inches and compact.
   2. Do not work on subgrade while ground is frozen or muddy.

D. Forming
    1. Forms shall be of full depth and shall be of such design as to permit secure fastening.
    2. Face boards if used, shall be so constructed and shaped that their lower edge conforms to lines and radii of structures.
    3. Use flexible or curved forms of proper radius for curves of one-hundred (100) foot radius or less.
E. Joints
    1. Traverse joints shall be located at intervals of ten (10) feet in curbs, gutters, and crosspans. For sidewalks tooled joints shall be at five (5) feet. Joints shall be continuous through all three elements. Joints shall be a minimum of one-quarter (¼) thickness of the concrete. Set joints at right angles to face, top, and flow line.
    2. Expansion joint material shall be installed between new structures and existing concrete, concrete pans, around fire hydrants, poles, inlets, other fixed objects, and between the ends of sidewalk slabs and curbs. Expansion joint material shall be vertical and with the top edge flush with the finished surface. The joint shall be edged with a suitable edging tool.
    3. Sealing Joints:
        a. Apply cold poured silicone sealant in accordance with manufacturer's written instructions. Backer rod is required.
F. Concrete Replacement
    1. Remove, dispose of and restore to original or better condition concrete drives, curbs, gutters, sidewalks, and similar structures that get damaged during construction.
        a. Remove concrete to neatly sawed edges or to existing smooth joint lines.
            i. Saw concrete to t/4 or if macro fibers are present to t/3.
            ii. If saw cut would fall within three (3) feet of construction joint, cold joint, expansion joint, or edge, remove concrete to the joint.
        b. Base course: Construct in accordance with the Standard Specifications.
            i. Restore to same thickness as existing, but in no case less than three (3) inches.
    2. Restore to existing alignment, dimensions and grades, or new alignment, dimensions and grades.
    3. Provide for a thirty (30) diameter lap if existing concrete that is removed contains reinforcing steel. New steel shall be of the same diameter and of equal or better quality.
    4. Restore all surface improvements to the same thickness as existing, but in no case less than the following:
        a. Driveway: Six (6) inches.
        b. Gutter: Six (6) inches measured at flowline.
        c. Sidewalk: Five (5) inches.
    5. Tool outside edges of sections and joints with a one-quarter (¼) inch radius edging tool.
G. Manhole Frames and Valve Boxes
    1. Prior to placing concrete adjust manhole frames and water valve boxes to final grade. Leave One-quarter (¼) inch below grade in areas of snowplowing.
    2. Immediately remove foreign matter, which is introduced into manholes, water valve boxes to provide free access to the facilities.
    3. Valve boxes and manhole rings shall be straight and properly aligned.
        a. Valve boxes shall be inspected by placing a valve key on the operating nut to ensure a proper alignment.
H. Finishing
    1. Trowel and brush face surface of curb and gutter.

2. Immediately after float finishing sidewalks and cross pans, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic flow.
3. Round back edge of curbs, lip of gutter adjacent to pavement, and edges adjacent to joints with edger of one-quarter (¼) inch radius.
4. Fill honeycombed back formed areas with mortar. Replace concrete sections when honeycomb is exposed to view.

I. Field Quality Control
1. Compact to accepted densities submitted with the mix design. The following are minimum densities in accordance with ASTM D698:
   a. Subgrade: Ninety- five percent (95%).
   b. Base Course: Ninety-five percent (95%).
2. The work shall be in accordance with the following tolerances:
   a. When checked with a ten (10) foot straightedge, grade shall not deviate by more than one-quarter (¼) inch and alignment shall not vary by more than one-half (½) inch. Final elevation shall not depart from plan elevation by more than one-half (½) inch.

END OF SECTION 32 10 00

32 90 00 – PLANTING

5/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for planting.
   1. Soil preparation and soil amendments.
   2. Finish grading fertilizer.
   3. Wood mulch.
   4. Weed barrier.
   5. Steel headers.
   6. Tree stakes and tree wrap.
   7. Plant materials.
   8. Seeding and sodding.

B. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Material boards with samples shall be submitted to the project manager so that all landscaping materials can be approved by the Parks department prior to their installation.

B. The sample materials must be keyed to a site plan that clearly shows each material's location. Keys should be based on color or number and not exclusively pattern.

1.04 QUALITY ASSURANCE

A. Contractor shall have at least five (5) years' experience in commercial landscape and irrigation maintenance and shall have prior experience in at least two other projects of similar size and scope.

B. Inspections:
   1. Site Inspection:
      a. Contractor will inspect existing site conditions and note irregularities affecting the work of this section.
      b. Verify that grading operations have been satisfactorily completed and that topsoil of adequate quantity and quality has been placed in areas as specified. Verify that the areas to be revegetated are protected from concentrated runoff and sediment from adjacent areas. Note previous treatments to the areas such as temporary seeding or mulching and discuss with the Owner's Representative how these treatments will affect permanent revegetation.
   2. Pre-Planting Inspection:
      a. Plant material shall be inspected by Owner before planting. Plants for inspection must be in a single location preferably on the project site. Rejected materials must be removed from the site, replaced and reinspected before planting. If the supplier is a local nursery, tagged plants may be inspected at the nursery. Photographs of the plant materials to be obtained from non-local sources may be submitted to the Owner's Representative for preliminary inspection. This preliminary inspection is subject to final approval of plants at the job site. The Owner reserves the right to reject plant material at any stage of construction or guarantee period.

b. Soil amendments, backfill mixes and mulches will be inspected at the site by the Owner's Representative before they are used in planting operations.
c. Owner's Representatives will inspect staked locations of trees before digging for those plants occurs. Owner shall inspect the location of shrubs in their containers at the proposed locations before digging commences. Contact Owner's Representative at least two (2) days in advance.

3. Substantial Completion Inspection:
   a. As soon as all planting is completed, a review and preliminary inspection to determine the condition of the vegetation will be held by the Owner upon request by the Contractor. If a second substantial completion review is required due to incomplete work, the contractor is responsible for the additional costs incurred by their consultants.
   b. The inspection will occur only after the following conditions have been met: Planting is completed; Sod is installed; Seeding is complete; Irrigation system shall be fully operational with heads properly adjusted; Landscape areas will be free of weeds and neatly cultivated; Plant basins shall be in good repair; Trees are staked or guyed; Debris and litter shall be cleaned up and walkways and curbs shall be cleaned of soil and debris left from planting operations.
   c. If, after the inspection, the Owner's Representative is of the opinion that the work has been performed as per the Contract, and that the vegetation is in satisfactory growing condition, Owner will give the Contractor Written Notice of Acceptance and the Guarantee Period shall begin.
   d. Work requiring corrective action in the judgment of the Owner shall be performed within the first ten (10) days of the guarantee period. Any work not performed within this time will necessitate an equivalent extension of the guarantee period. Corrective work and materials replacement shall be in accordance with the Contract, and shall be made by the Contractor at no cost to the Owner.
   e. Final approval and Substantial Completion notice will be given when all deficiencies are corrected.
4. End of Guarantee Period Inspection:
   a. At the end of the first and second full growing season the Owner will inspect trees for satisfactory condition. The inspection shall take place in September and the Owner shall contact the Contractor concerning replacements. Replacements may take place the following spring if deemed proper or necessary.

C. Plant Material Guarantee/Warranty Period:
1. Provide a two-year warranty from the date of Substantial Completion. Substantial Completion is hereby defined as the point at which the Landscape Contractor is one hundred percent (100%) complete with installation and is ready for a Substantial Completion Review. The Owner will have sole authority to grant Substantial Completion. The minimum two-year warranty includes all aspects of this section including installation, and materials.
2. Guarantee plant material used in this section against defects due to any cause for a period of two full growing seasons from the date of acceptance of all work. This guarantee includes insect infestation or infection by disease organisms.
3. Replace woody vegetation when it is no longer in a satisfactory condition as determined by the Owner for the duration of the Warranty Period. Make replacements within fourteen (14) days of notification from the Owner. Replacement planting for trees shall be done in the spring planting season, except as approved otherwise. If a tree is in marginal condition at the end of the guarantee period, it may be agreeable to both parties to wait until the end of the

growing season before deciding whether to replace that tree. Plant materials that are replaced during the warranty period shall be replaced one time at the Contractor's expense. Cost of subsequent replacements, if required, shall be negotiated with the Owner. Warranty replacement plant materials planted within six (6) months after Substantial completion shall have the same end of warranty as the original installation. Plants replaced within six (6) months of the end of the warranty shall be warranted an additional six (6) months after the date of completion of the initial warranty period.

4. It is the responsibility of the Landscape Contractor to monitor ongoing maintenance of the project during the warranty period. If the Landscape Contractor finds fault with ongoing maintenance activities of the Maintenance Contractor, they shall be immediately brought to the attention of the Owner. The warranty will in no way be invalidated because of activities of the Maintenance Contractor unless approved by the Owner's Representative.
5. Replacements shall be of the same kind and size as originally specified. Repairs and replacements shall be made at no expense to the Owner.

D. Seed and Sod Guarantee/Warrantee Period:
   1. Guarantee seed and sod against defects for a period of two growing seasons from the date of final acceptance.
   2. Replace turf when it is no longer in a satisfactory condition as determined by the Owner’s Representative for the duration of the warrantee period.
   3. Areas seeded in the spring shall be inspected for required coverage the following fall no later than October. Areas seeded in the fall will be inspected October of the following year.

PART 2 – PRODUCTS

2.01 LANDSCAPE PRODUCTS

A. The landscape products include: Steel edging, tree stakes, soil amendments, fertilizer, wood mulch, weed barrier fabric, tree wrap, plant materials, seed and sod.
B. Utilize locally sourced materials where feasible.
C. Utilize recycled content material for weed barrier fabric, tree wrap, steel edging and tree stakes where feasible.
D. Use recycled content mulch where applicable.
E. Consider using one hundred percent (100%) recycled cellulose in spray applied mulch.

2.02 AMENDMENT

A. Submit a minimum of two (2) samples of soil to the Colorado State University (CSU) Soil Testing laboratory for analysis and fertilizer recommendations. Samples shall be taken from widely varying sections of the site.
B. Organic material amendments required.

2.03 FERTILIZER

A. Fertilizer for seed and sod shall be commercial type, of uniform composition, free flowing, and conforming to applicable state and federal laws. Fertilizer shall be formulated to meet the suggestions of the CSU soil laboratory for turf fertilization.
B. Fertilizer for trees, shrubs, and perennials: no special requirements, evaluated on case-by-case basis.
C. Microbial treatment should be considered on a case-by-case basis.

2.04 SODDING

A. Sod shall be Colorado grown. Use “big roll” where possible.

2.05 PLANTS

A. Reference City of Fort Collins Forestry Plant List.
B. Preference given to native, water conserving species. Non-native species must be noninvasive.

C. Minimum Tree Sizes:
   1. Deciduous Trees: Two (2) inch caliper minimum.
   2. Evergreen Trees: Six (6) foot height minimum.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Soil Preparation and Finish Grading
   1. Do not plant until finish grade has been reviewed by the Owner. This review does not reduce Contractor's responsibility to provide a finished product that drains.

B. Tree and Shrub Planting
   1. Tree Staking: Prior to planting, stake all proposed tree locations for review by the Owner's Representative**.** Any plant material installed prior to this review is subject to removal or relocation at the expense of the Contractor.
   2. Planting Pits:
      a. Dig planting pits twice the diameter of the rootball for container and balled and burlapped stock. Establish bottom of the planting pit so that the top of rootballs will be slightly higher than surrounding grade in order to allow for settlement. Roughen edges of planting pits to provide a rough surface on edges. Retain excavated material next to planting pit for mixing organic amendment and fertilizers.
      b. For planting trees amend excavated planting pit soil with organic amendment.
   3. Shrub Planting:
      a. Remove stock from containers including shrubs in peat pots. Do not break the rootballs.
      b. Apply Osmocote fertilizer at the base of the plant after backfilling. Apply at manufacturer's recommended rate. Water lightly to activate fertilizer.
   4. Tree Planting:
      a. Establish planting pit as specified above.
      b. If trees are containerized, remove trees from containers. If trees are balled and burlapped, leave burlap firmly secured until after planting.
      c. Handle trees carefully during planting. Avoid excessive shaking and rapid movements. Protect tree trunks with a soft cloth or rubberized material when handling by the trunk.
      d. Roughen the sides of planting pits.
      e. Gently lower tree into planting pit and set plumb. Establish bottom of pit so that top of tree root ball is approximately two (2) inches above surrounding grade. Protect trunk and tree branches while placing tree. Untie and remove burlap from the top one-third (1/3) of the root ball. Remove wire basket from root ball. Backfill tree planting pit using the mixture described in section above. Backfill one-half of pit with backfill mixture and water in thoroughly before placing any more backfill.
      f. Backfill the rest of the planting pit with backfill mixture and water in thoroughly. Lightly compact backfill. Do not vigorously compact. Apply slow release Osmocote fertilizer around the root ball diameter of the tree. Apply at manufacturer's recommended rate. Stake evergreen and deciduous trees. Trees should be plumb. Install two (2) stakes per. Wrap deciduous trees with specified tree wrap. Wrap from bottom of trunk to the first major lateral branch. Secure with jute or other biodegradable material. Install after November 15 and no later than December 15. Remove wrap approximately March 15 and no later than April 15. If there are spade dug and planted trees, they shall be deep

watered with a watering needle angling from the inside of the ball out toward the perimeter.

END OF SECTION 32 90 00

DIVISION 33: Utilities

33 05 00 – COMMON WORK RESULTS FOR UTILITIES

5/25

PART 1: GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for utilities. Additional requirements may be included within specific agreements or other contracting documents.

B. All design and construction within Division 33: Utilities are to reference the City of Fort Collins Utilities Builders and Developers Forms, Guidelines and Regulations Website (see Appendix A), unless noted otherwise.

1. The following sections are to follow the BDCS:
    a. 33 36 00 – Utility Septic Tanks.
    b. 33 44 16 – Utility Trench Drains.
    c. 33 46 13.13 – Foundation Draining Piping.
    d. 33 71 73 – Electrical Utility Services.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 33 00 00

33 36 00 – UTILITY SEPTIC TANKS

05/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for utility septic tanks. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grease Interceptors and Traps
   1. General
      a. Unless written approval is given by the Owner, all food serving, food preparation, food catering, meat cutting establishments; fish, fowl, animal slaughterhouses, soap factory, tallow rendering, fat rendering, hide curing establishments; and others capable of discharging large amounts of grease into the sanitary sewer system, shall be required to install a grease interceptor.
      b. Grease interceptors shall not be required for private residences or dwellings.
      c. Owners of businesses that may require grease interceptors shall submit plans to the Owner for review and approval.
   2. Location
      a. Unless prior permission is given by the Owner, all grease interceptors shall be located outside, on private property, within thirty (30) feet of the facility served, and shall be easily accessible at all times for maintenance and examination.
      b. All grease interceptors shall have two compartments, the smallest of which shall have at least one-third (1/3) the capacity of the entire interceptor. No two-piece traps will be accepted.
   3. Size
      a. The size of grease interceptors shall be determined by the Owner and Architect/Engineer.

B. Combination Sand & Oil Interceptors
   1. General
      a. Unless written permission is obtained from the Owner, all service stations, truck or car wash facilities, vehicle maintenance facilities, machine shops and others where significant amounts of sand, oil and/or flammable wastes could enter the sanitary sewer system, shall be required to install a combination sand & oil interceptor.
      b. Owners of businesses that may require sand & oil interceptors shall submit plans to the Owner for review and approval.
   2. Location

a. All combination sand & oil interceptors shall be located outside, on private property, within thirty (30) feet, and not less than five (5) feet, of the facility served and shall be accessible at all times for maintenance and examination.
b. All combination sand & oil interceptors shall have two compartments, the smallest of which shall have at least one-third the capacity of the entire interceptor.

3. Size
   a. The size of combination sand & oil interceptors shall be determined by the Owner.
      i. A fixture unit count for the various drains shall be determined following the values listed below:
         1. Three (3) inch diameter floor drains shall be rated at six (6) fixture units.
         2. Four (4) inch diameter floor drains shall be rated at eight (8) fixture units.
         3. If trough drains are used, each bay, or compartment, or area equaling the square foot surface of a standard service station bay which is served by the trough drain shall be rated at six (6) fixture units per bay.
         4. Vehicle wash drains shall be rated at eight (8) fixture units, regardless of the size.
            1. The total number of fixture units times 7.5 gallons per minute equals the maximum flow rate.
            2. The maximum flow rate times a five (5) minute retention time equals the required volume of the sand & oil interceptor.
            3. For example: Two (2) three (3) inch floor drains equals twelve (12) fixture units (f.u.) times 7.5 gpm times five (5) minute retention equals four hundred-fifty (450) gallons.
      ii. Combination sand & oil interceptors smaller than three hundred-twenty (320) gallons will not be allowed.

C. Venting
   1. General
      a. All grease interceptors, with the exception of in-line traps, and combination sand & oil interceptors shall be vented.
   2. Materials
      a. Acceptable materials for vent pipe are:
         i. Cast iron.
         ii. Copper.
         iii. Brass.
         iv. There will be no substitutions allowed.
      b. Acceptable materials for vent fittings are:
         i. Cast iron.
         ii. Copper.
         iii. Brass.
         iv. ABS.
         v. PVC.
         vi. There will be no substitutions allowed.
      c. Galvanized wrought iron and galvanized steel pipe and fittings will not be allowed underground.
      d. Changes in the direction of vent piping shall be made by the appropriate use of fittings, and no such piping shall be strained or bent.
         i. Burred ends shall be reamed to the full bore of the pipe.
   3. Size of Vents

a. The size of vent piping shall be determined from its length and the total number of fixture units connected, as shown in the following chart.
    i. Venting for grease and combination sand & oil interceptors:

Pipe Diameter	Number of Fixture Units	Lengths
1 ¼"	1	45
1 ½"	8	60
2"	24	120
2 ½"	48	180
3"	84	212
4"	256	300
5"	600	390
6"	1380	510

        1. The minimum size of vent piping shall be three (3) inches for all grease interceptors and all combination sand & oil interceptors.
    ii. A vent may exceed one-third (1/3) of the maximum horizontal length as limited by the above chart, only if the vent is increased one pipe size for its entire length.

4. Vent Pipe Grades and Connections
    a. All vent pipes shall be free of drops or sags.
    b. All vent pipes shall be level, or graded in such a manner to drip back by gravity to the drain pipe that the vent pipe serves.
    c. Vent pipes which connect to a horizontal drainage pipe shall be connected above the center line of the drainage pipe, and ahead of the trap being served.
    d. All vent pipes shall rise vertically to a point not less than six (6) inches above the flood level rim of the structure being served before off setting horizontally.
        i. When two or more vent pipes converge, each pipe shall rise to a point at least six (6) inches above the flood level rim before being connected to any other vent pipe.
    e. All vent pipes which serve in-line grease interceptors shall extend undiminished in size until above the roof.
        i. Weather heads will not be allowed.
        ii. All vent pipes shall terminate at a point not less than ten (10) inches above the roof vertically, and not less than one (1) foot from a vertical surface.
        iii. All vent pipes shall terminate at a point not less than ten (10) feet horizontally nor less than three (3) feet vertically from any window, door, air intake, vent shaft, or any other type of opening.
        iv. All vent pipes shall not terminate at a point closer than three (3) feet from a lot line.
            1. Lot lines which abut an alley or street are excepted.
    f. Vent pipes for outdoor installations shall extend a minimum of ten (10) feet above the surrounding ground and shall be securely supported.

END OF SECTION 33 36 00

33 44 16 – UTILITY TRENCH DRAINS

05/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY
- A. Section includes administrative and procedural requirements for utility trench drains. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS
- A. Shop Drawings.
- B. Recommended Method of Installation.

1.04 QUALITY ASSURANCE
- A. Manufacturer/Installer Experience:
  1. At least five (5) acceptable installations within the past five (5) years.
- B. Warranty
  1. Two (2) year coverage period.

PART 2 – PRODUCTS

2.01 PRODUCTS
- A. Physical and Mechanical Characteristics:
  1. Overall Width: 6.1 inches.
  2. Internal Width: Four (4) inches.
  3. Unit Depth: 7.6 inches.
  4. Compressive Strength of Specified Polymer Concrete: Fourteen thousand (14,000) psi.
  5. Flexural Strength of Specified Polymer Concrete: Three thousand (3,000) psi.
  6. Water Absorption Rate: Not to exceed 0.1% by weight.
- B. Channel Profile:
  1. Shall include positive interlocking tongue and groove connections that can be sealed to provide watertight connections. Each pre-cast polymer concrete one meter (39.37 inches) unit shall be an open U-shaped channel to accept a grate 4.84 inches wide.
- C. Grates:
  1. Standard ACO Drain grates (or approved equal) and locking mechanism, galvanized steel slotted.
- D. Catch Basins:
  1. Shall be pre-cast polymer concrete one half meter (19.69 inches) in length and include a trash bucket and removable grating.

PART 3 – EXECUTION

3.01 PREPARATION
- A. Excavate the area for channel placement wide enough and deep enough to accommodate the channel size and a minimum of four (4) inch concrete encasement.
- B. Channels require a minimum of four (4) inches of concrete support on both sides as well as underneath the channel and the top of channel must be evenly aligned to the surface of the surrounding slab.

3.02 INSTALLATION

A. Install in strict accordance with manufacturer's recommendations and contract documents.
B. Channel sections are installed from the outlet ends of the system, working from the catch basins.
C. Insert channels from above to allow ends to interlock. Channel sections shall be placed on rebar basket, low slump concrete grout slurry, or suspended to obtain correct finished elevation.
D. Cutting will be made, if required, by masonry or concrete saw. Temporarily place grate in channel to avoid compression during concrete placement. Protect grated and channel interior during concrete pour.

END OF SECTION 33 44 16

33 46 13.13 – FOUNDATION DRAINAGE PIPING

05/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for foundation drainage piping. Additional requirements may be included within specific agreements or other contracting documents.

1.03 SUBMITTALS REQUIRED

A. Certification.

PART 2 – PRODUCTS

2.01 DRAINAGE PIPE AND ACCESSORIES

A. Piping:
   1. Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars, and joint materials.
   2. Polyvinyl Chloride Pipe: ASTM D2729, perforated and plain.

B. Accessory Materials:
   1. Filter Fabric: Four (4) ounces per square yard polypropylene fabric.

2.02 SOIL MATERIALS

A. Backfill: Soil materials as approved for fill and backfill.

B. Drainage Fill: Uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand with one hundred percent (100%) passing a 1.5-inch sieve and zero percent (0%) to five percent (5%) passing a 0.25-inch sieve.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Perimeter Foundation Drainage System:
   1. Grade perimeter drain trenching to permit positive drainage not less than 0.125 inch per foot.

B. Filtering Material:
   1. Line bottom and sides of trench with filter fabric with single width, extended up sides of trench to permit full lap when folded over top of drainage fill.
   2. Place a supporting layer of drainage fill material on filter fabric over compacted subgrade where drainage pipe is to be laid to the depth indicated or, if not indicated, to a compacted depth of not less than four (4) inches.

C. Laying Drain Pipe:
   1. Lay drain pipe solidly bedded in drainage fill material.
   2. Provide full bearing for each pipe section throughout its length, to true grades and alignment, and continuous slope in the direction of flow.
   3. Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturer's recommendations.
   4. Provide collars and couplings as required.

5. Extend from low point of drainage system with unperforated pipe to daylight discharge or storm sewer sump as shown on drawings. Sump, pump and cover are included in Division 26 sections.

D. Testing Drain Lines:
   1. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

E. Drainage Fill:
   1. Place drainage fill over drain lines after satisfactory testing. Completely cover drain lines to a width of at least six (6) inches on each side and twelve (12) inches above top of pipe, unless more coverage is indicated on the drawings. Place fill material in layers not exceeding three (3) inches in loose depth and compact each layer placed.
      a. Fold filter fabric over top of drainage fill with full lap.

F. Fill to grade.

END OF SECTION 33 46 13.13

33 71 73 – ELECTRICAL UTILITY SERVICES

05/25

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for electrical utility services. Additional requirements may be included within specific agreements or other contracting documents.

PART 2 – PRODUCTS

2.01 PRODUCTS

A. Main Distribution Switchboard/Panelboards: Copper or tin-plated aluminum bus bars.
B. Safety Switches: Heavy-duty type fusible or nonfusible, NEMA rating for environment installed.
C. Transformers shall be a high efficiency type. Sound levels shall not exceed the level listed by ANSI-C89. Transformers to be mounted with additional isolation pads and electrical connections made with flexible conduit.
D. Electrical services to include twenty-five percent (25%) spare capacity for future.
E. Provide twenty-five percent (25%) spare capacity and space in all branch circuit panels.
F. Provide three (3) spare fuses for each size installed. Provide appropriate size spare fuse cabinet to store spare fuses.
G. Label all spare conduits on each end as to where it originates and terminates.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install three-quarters (¾) inch conduit from electric meter(s) to main com/data room.
B. Install three-quarters (¾) inch conduit from gas meter(s) to main com/data room.
C. Install three-quarters (¾) inch conduit from water meter(s) to main com/data room.

END OF SECTION 33 71 73

Appendix A: Stormwater Management Plan

City of Fort Collins

SWMP
Stormwater Management Plan
Binder Guide

City of Fort Collins
Operation Services

City of Fort Collins - Facility Services
300 Laporte Avenue, Bldg. D
FORT COLLINS, CO 80522
(970) 221-5851 FAX (970) 221-6334

Appendix B: Quality Assurance / Quality Control Plan

CITY OF FORT COLLINS
QUALITY ASSURANCE / QUALITY CONTROL PLAN

QA-QC Outline

1. The Quality Control Organization & Team Responsibilities
   A. Design Phase
   B. Construction Phase
   C. Team QA/QC Responsibilities

2. Project Quality Plan Checklist

3. Quality Appointment Letters

4. QA/QC Specification for Submittal Requirements & Procedures

5. Definable Features of Work

6. 3-Phase QA-QC Checklist & Tracking
   A. Preparatory Phase
   B. Initial Phase
   C. Follow up Phase

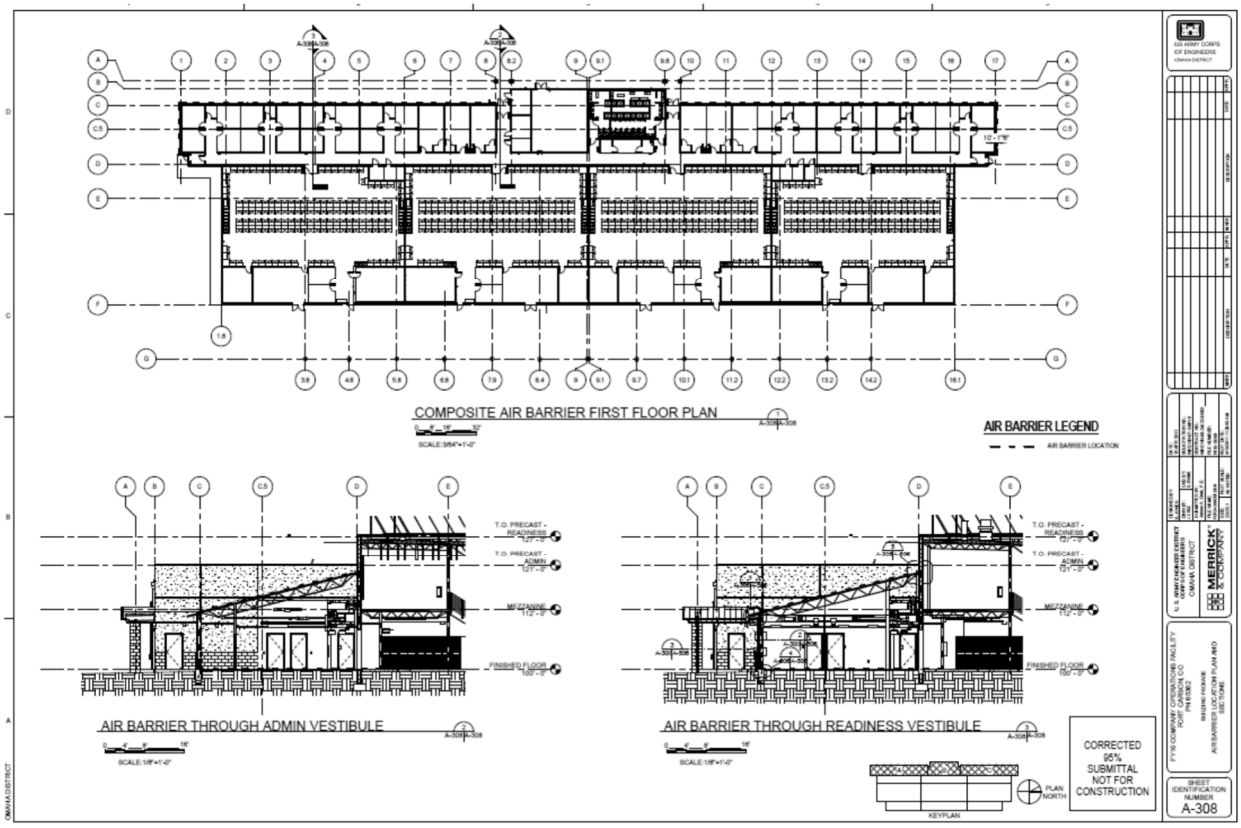
7. QC Testing and Inspections Procedures & Log

8. QC Deficiency Tracking Log & Correspondence

9. QC Project Close-out
   A. Building Commissioning Report
   B. Building Blow Door Report
   C. Project Warranties Verified
   D. O&M Approval
   E. Record Drawing Approval

10. Project Warranty Request & Warranty Log

Appendix C: Bldg Envelope Air Barrier Dwg.



Appendix D: Thermal Bridging-

Photo 1 (left): "Harley Davidson" Architecture. The projecting concrete slabs transfer heat across the enclosure. Photo 2 (right): Architectural Statement. Apparently, the projecting slab is visually appealing (who knew?). It catches rain and transfers heat efficiently while wasting floor area (square footage).

Photo 3: Exposed Frame. The bad news is that we have built lots of these. The good news is that they are easy to fix by recladding them with exterior insulation.

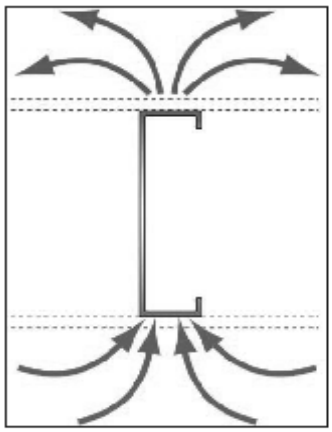


Figure 1: Efficient Heat Transfer. Steel studs are designed to provide the maximum possible conductive energy transfer across a wall using the minimum amount of material—a thin web with cleverly designed heat transfer fins (flanges) on both sides to efficiently absorb heat on one side and reject it on the other.

A Bridge Too Far

Thermal Bridges—Steel Studs, Structural Frames, Relieving Angles and Balconies

By Joseph W. Lstiburek, Ph.D., P.Eng., Fellow ASHRAE

For a bunch of supposedly clever folks, we sure do dumb things. One of the big ideas of the past couple of decades is to keep the heat out during cooling and keep heat in during heating. The better we are at this, the less energy we need to use to condition the interior. Apparently, this concept has not caught on. How else do we explain modern construction that uses steel, concrete, aluminum and glass the way we do? For those who somehow missed high school physics, steel, concrete, aluminum and glass are all thermally conductive materials. Except for concrete, we make frying pans out of all of them.

If an alien from another planet looked at our construction practices, he would conclude that we have too much heat in buildings, and we want to reject that heat to the outside.* We expose our concrete slab edges and our concrete frames. We build our structures like heat exchangers with protruding fins that transfer every last available Btu across them—like huge concrete Harleys with air-cooled structural frames (*Photos 1, 2,* and *3*).

This logic (actually illogic) starts with the field of the wall. Steel studs are designed to provide the maximum possible conductive energy transfer across a wall using the minimum amount of material—a thin web with cleverly designed heat transfer fins (flanges) on both sides to efficiently absorb heat on one side and reject it on the other (*Figure 1*). It gets even worse when steel studs are used with a steel frame (*Photo 4*). It is pointless to insulate the cavity to fight this efficiency of heat transfer. Of course, if it is pointless, we do it. The lunacy has progressed to the point where we are using higher and higher thermal resistance cavity insulations, such as expensive spray foams. Why waste money on cheap insulation when we can waste even more on expensive insulation?

The only solution is to insulate on the outside of the steel studs, which is easy, elegant, effective and efficient. Leave the cavity empty and put the insulation on the outside (*Photo 5*). Done. Except when we actually do this, we don't get the credit for it we deserve. We get penalized code-wise and cost-wise. Place

* This line of logic (or rant) has been shamelessly stolen from John Straube, professor of civil engineering, University of Waterloo, which is a pretty good university as universities go. It's almost as good as the University of Toronto, my alma mater.

Appendix E: PARAPET DETAIL

Parapets
Where Roofs Meet Walls

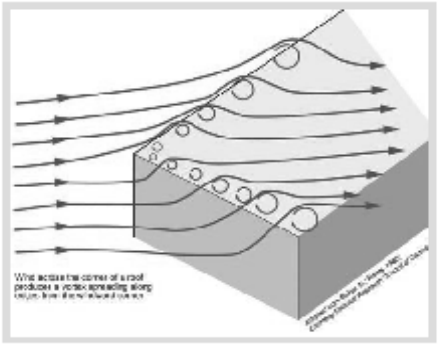


Figure 1: Roof Edge Wind Effects. When wind blows against a building, it produces vortices at the roof edges.

By Joseph W. Lstiburek, Ph.D., P.Eng., Fellow ASHRAE

Historically, so many problems have occurred with parapets that we have a name for it: "*parapetitus*." They have a long history—which of course is not always clear— that allows me to embellish without threat of peer review reversal.* Their major function today, aside from confusing architects, is to protect the edge of roof assemblies from wind uplift forces. Not so in the old days where they were useful in fire protection.

When wind blows against a building it produces vortices at the roof edges (*Figure 1*) that create huge pressure differences (*Figure 2*) at roof perimeters that can suck roofs off buildings. Parapets dramatically reduce these pressure differences at roof edges (*Figure 3*). Neat eh? All this from a University of Toronto guy, go Varsity Blues (Leutheusser, H.J., 1964[2]).

The easiest thing to get right about parapet construction is to keep rainwater from getting into the top of them. The principles are easy. Slope the top of them inward so they don't stain the building façade. Make sure that there is a waterproof membrane under the coping. Always. Metal and stone copings leak at joints. And always have drip edges—front and back—so that they don't stain the building façade. Did I mention the staining of the building façade? Check out *Figure 4* and *Photo 1* to see it done right. If you want to get depressed, look at *Photo 2*.

Are we done yet? Nope, not by a long shot. Now it gets weird, not the physics, but why so many buildings get the physics wrong. For the physics we go to another one of those legendary old guys who got it right and made it simple for the rest of us to understand—Max Baker. Check out *Figure 5*, adapted from his book "Roofs." Connect the water control element/layer of the roof to the wall, the air control element/layer of the roof to the wall, the vapor control element/layer of the roof to the wall and finally the thermal control element/layer of the roof to the wall. Sound familiar? Coming from me it should by now.† I call them the "Baker Principles."

This is what we typically get in the "real world" today (*Figure 6*). What a mess. No continuity of the four principle control layers:

- Water control layer: no membrane under the parapet flashing;
- Air control layer: no air control in either the roof assembly or the wall assembly;
- Vapor control layer: same goes for the vapor control layer; and
- Thermal control layer: thermal bridging everywhere.

And to make matters worse, structurally we also tend to have some issues. Ah, but not in the way you think. Think about the thermal stress a roof membrane goes through (*Figures 7* and *8*). The key is to transfer these stresses to the roof deck. In the old days it was easy; just fully adhere the roof membrane with a lot of goop directly to the structural deck so that each square foot of roof membrane stress was directly transferred to the square foot of structural deck directly under the membrane. No problem. Until, wait for it, some lunatic person introduced thermal insulation. Now we had to transfer the