Preparer's Certification for Specifications, Special Specifications, Special Provisions, Estimate and Specification Data

FOR:

The project consists of Demolition of District Attorney Building located at 201 Fannin Street in Downtown Houston, built in 1936 as a Federal Office Building for the U.S. Treasury Department. The building has remained vacant for approximately ten years. The Demolition to include 10 stories with a mezzanine level, partial basement and penthouse, totaling approximately 85,000 SF. Basement wall foundation to remain in-place and wall to be cut as indicated by structural drawings. Demolition also include the overhead pedestrian bridge at level 4 connecting District Attorney Building and adjacent Family Law Center. The work also consists of providing new enclosure of the opening at Family Law Center to match existing construction and providing new Surface parking lot with minimum required landscaping on approximate 12,738 SF existing District Attorney Building site.
Limits: Site is approx 12,738 SF located on Lots 6, 7, and the north 1/2 of lot 12 Block 22, South side of Buffalo Bayou located in the John Austin Survey Precinct 1
UPIN 16035MF0FY01

Special Note:

The following items developed per the published Construction Drawings have been verified and included in the Purchasing Department's Bid Specification Package which can be located at https://www.civcastusa.com/. The items include:

- Pricing/Delivery Information
- Scope of Work
- Special Specifications
- Contract Time

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TABLE OF CONTENTS

Scope of Work:

The project consists of Demolition of District Attorney Building located at 201 Fannin Street in Downtown Houston, built in 1936 as a Federal Office Building for the U.S. Treasury Department. The building has remained vacant for approximately ten years. The Demolition to include 10 stories with a mezzanine level, partial basement and penthouse, totaling approximately 85,000 SF. Basement wall foundation to remain in-place and wall to be cut as indicated by structural drawings. Demolition also include the overhead pedestrian bridge at level 4 connecting District Attorney Building and adjacent Family Law Center. The work also consists of providing new enclosure of the opening at Family Law Center to match existing construction and providing new Surface parking lot with minimum required landscaping on approximate 12,738 SF existing District Attorney Building site.

GENERAL NOTICE TO CONTRACTORS

In accordance with House Bill 1059, a minimum of 25% of the work to be performed on this project shall be performed by the Bidder.

Special Notice: By law, the original price on firm fixed price contracts may not be increased by more than 25%. The original price may not be decreased by 18% or more without the consent of the contractor. Please monitor additions to your contract - additions in excess of 25% will not be paid under any circumstances.

On public works projects, all contractors shall supply a list of all suppliers and subcontractors with addresses and phone numbers, prior to work commencing.

At the time of the scheduled preconstruction meeting, the successful bidder shall supply to the County a list of representatives signed by an Officer of the Company who are authorized to sign official documents, i.e., Purchase Orders, Change Orders, Final Estimates, etc.

In determining who is a responsible bidder, Harris County may take into account the past performance of the bidder on Harris County projects. Commissioners' Court adopted a written definition and criteria for determining the performance of a contractor which may be considered in determining the responsibility of a bidder.

Harris County is using internet-based software "Capital Projects Management and Tracking System (CAPTRAC)" to maintain consistent administrative and technical control for its projects throughout the County. The Contractor is required to use CAPTRAC on this project in accordance with procedures provided (the User's Guide and Quick Reference Guide in Construct-It under Help link) by the County. CAPTRAC stores electronic project correspondence and related project documents such as RFI's (requests for information) and submittals. CAPTRAC provides the ability to view contract bid items/pay estimate status, submittal status, RFI status, and change order history, etc.

At no cost to the Contractor, the County will provide system login account(s) and provide training for Contractor personnel. The Contractor must update CAPTRAC with any new or changed information within 24 hours of that information becoming known to Contractor.

Therefore, the Contractor must have access to a computer with internet access and a scanner to use CAPTRAC.

GENERAL NOTES

1. In the computation of contract time, Saturdays, Sundays, and Holidays are included, however, there is sufficient time in Monday through Friday for the completion of the project. Therefore, any work on Saturdays, Sundays, and Holidays must be approved 48 hours in advance by the County Engineer.

Notice to Contractors
of
Texas Board of Professional Engineers Policy Advisory Regarding Procurement of Engineering Services By General Construction Contractors for Governmental Public Works Projects

On August 20, 2009, the Texas Board of Professional Engineers adopted a document entitled "Texas Board of Professional Engineers Policy Advisory Regarding Procurement of Engineering Services by a general Contractor for Governmental Public Works Projects". A copy of said Advisory is attached for information should the Contractor decide to obtain any professional engineering services in accomplishing this Project.

Texas Board of Professional Engineers
Policy Advisory Regarding Procurement of Engineering Services by General Construction Contractors for Governmental Public Works Projects

August 20, 2009

Definitions:
Project Professional Engineer – Engineer(s) or engineering firms retained by a governmental entity to perform engineering services for a specific public works project.
General Construction Contractor – Private entity retained by a governmental entity to construct a public works project designed by the Project Professional Engineer.
Other Professional Engineers – Engineer(s) or engineering firms which may be retained by the General Construction Contractor or his subcontractors or vendors to fulfill engineering requirements of the project during the construction phase.

Background: The Dallas – Ft. Worth International Airport Board (DFWIAB) has requested clarification on the Texas Board of Professional Engineers' (Board) interpretation of the Professional Services Procurement Act (PSPA) requirements contained in the Texas Engineering Practice Act (Act). In the course of complex public works projects, the need often arises for Other Professional Engineers to be engaged to perform tasks unforeseen by the Project Professional Engineers or tasks not authorized to be performed by the Project Professional Engineers since they would involve dictating the General Construction Contractor's means and methods of construction. Examples of such engineering tasks include but are not limited to:

1) Trench safety plans.
2) Traffic control plans.
3) Temporary construction structures (crane foundations, for example).

Applicable Board Rules from the Act:

§137.53 Engineer Standards of Compliance with Professional Services Procurement Act
(a) A licensed engineer shall not submit or request, orally or in writing, a competitive bid to perform professional engineering services for a governmental entity unless specifically authorized by state law and shall report to the board any requests from governmental entities and/or their representatives that request a bid or cost and/or pricing information or any other information from which pricing or cost can be derived prior to selection based on demonstrated competence and qualifications to perform the services.
(b) For the purposes of this section, competitive bidding to perform engineering services includes, but is not limited to, the submission of any monetary cost information in the initial step of selecting qualified engineers. Cost information or other information from which cost can be derived must not be submitted until the second step of negotiating a contract at a fair and reasonable cost.
(c) This section does not prohibit competitive bidding in the private sector.
Source Note: The provisions of this §137.53 amended to be effective June 4, 2007.

§137.79 Standards for Compliance with Professional Services Procurement Act
When procuring professional engineering services, a governmental entity and/or its representative(s) shall comply with the requirements of Subchapter A, Chapter 2254, Texas Government Code and shall select and award on the basis of demonstrated competence and qualifications to perform the services for a fair and reasonable price and shall not select services or award contracts on the basis of competitive bidding.

Adopted by the Texas Board of Professional Engineers August 20, 2009

Source Note: The provisions of this §137.79 amended to be effective December 21, 2008.

Analysis of Board Rules, Texas Administrative Code, Title 22, Part 6, Chapter 137: A reading of Board Rule 137.53 reveals that no language exists specific to the selection of Other Professional Engineers that may be required during the construction phase of the project and that would be selected by a General Construction Contractor. Rule 137.53 is specific, however, in that all professional engineers must not divulge cost information prior to being selected solely on their qualifications. The rule also requires licensed professional engineers to report to the Board any instance where a governmental entity and/or their representative requests cost information prior to the qualification based selection phase. The board would interpret a General Construction Contractor to be a representative of the governmental entity. Similarly, Board Rule 137.79 requires that governmental entities or their representatives use qualification based selection processes.

Process: If professional engineering services are required during the course of the project, the public entity or the General Construction Contractor must use qualification based selection to procure all engineering services regardless of when the services are required. The following language is used by the DFWIAB in their contract documents to communicate this requirement to their contractors and representatives:

> *Ancillary/ Integral Professional Services: In selecting an architect, engineer or land surveyor, etc., to provide professional services, if any, that are required by the specifications, bidder shall not do so on the basis of competitive bids but shall make such selection on the basis of demonstrated competence and qualifications to perform the services in the manner provided by Section 2254.004 of the Texas Government Code and so shall certify to the Board (DFWIAB) with its bid.*

The above contract language covers instances where a General Construction Contractor's means and methods would trigger the requirement for Other Professional Engineering services that were not performed by the Project Professional Engineers. Examples include traffic control plans for contractor controlled disruptions of normal traffic, or instances where Other Professional Engineering services would be sought to build a temporary crane foundation. The General Construction Contractor would use a qualification based selection process to select Other Professional Engineers and would certify in writing to the governmental entity that the QBS process was followed and no pricing or costing data was used in the process.

Limitations: The QBS process performed by General Construction Contractors described in this policy advisory is intended only for those limited instances where:

1) Engineering decisions or designs performed by the governmental entity's Project Professional Engineer would interfere with the contractor's means and methods of construction or

2) Unforeseen construction issues necessitate the services of Other Professional Engineers in the course of the project.

Adopted by the Texas Board of Professional Engineers August 20, 2009

SPECIAL NOTICE TO CONTRACTORS

In the hauling of construction materials, excavation equipment or other items required in the completion of this project, the attention of prospective bidders is directed to ordinances and regulations of local, municipal, or county governments which limit the type or the gross weight of motor vehicle or construction equipment operating on public roads and streets or which restrict the use of such equipment on certain streets.

It will be the responsibility of prospective bidders to investigate any limitations in routing, size of equipment, or gross vehicle weights which may be subject to regulations by local governmental jurisdictions.

Attention of prospective bidders is also invited to the provisions of City of Houston Ordinance No. 62-888, dated June 20, 1962, which requires the licensing of vehicles which are used in the transportation of earth, sand, shell, gravel and similar construction or excavated materials.

Approved by Harris County Commissioners' Court July 23, 1962, Vol. 51.

NOTICE TO CONTRACTORS ON STORM WATER QUALITY AND ENVIRONMENTAL ISSUES

In addition to the regulatory requirements stated in the General Conditions, the Contractor shall recognize and comply with the following:

SECTION 1. STORM WATER POLLUTION PREVENTION PLANS

A. COVERAGE

Coverage under the Texas Pollutant Discharge Elimination System (TPDES) General Permit TXR150000 for storm water discharges associated with construction activities is required for a project that disturbs 1 acre or greater (or is a part of a larger common plan of development with the potential to disturb 1 acre or greater). Coverage requires the preparation, implementation, inspection, and maintenance of a Storm Water Pollution Prevention Plan (SWPPP), in accordance with the TPDES General Permit.

B. PROJECT CLASSIFICATION

This project is classified as one of three categories listed below. The Contractor shall be responsible for the storm water quality items, accordingly.

1. "**Construction Sites That Do Not Require TPDES General Permit Coverage**"

   The project disturbs less than 1 acre (and is not part of a common plan of development with the potential to disturb 1 acre or more); therefore, coverage under the TPDES General Permit is not required. However, the Contractor shall implement good housekeeping measures to minimize the potential for pollutants, associated with the construction activities, to enter the storm sewer system. Item 725, "General Source Controls", shall be implemented by the Contractor, as well as any other erosion, sedimentation, and pollution controls shown in the plans and project manual.

or

2. "**Small Construction Sites**"

   The project disturbs 1 acre or more, but less than 5 acres, (or is part of a common plan of development with the potential to disturb 1 acre or more); therefore, coverage under the TPDES General Permit is required. The Contractor shall implement, inspect, and maintain the Storm Water Pollution Prevention Plan shown in the plans and project manual. Certification of a TCEQ Small Construction Site Notice (CSN) in accordance with Part II.E.2 of the TPDES General Permit is required. **The Contractor, as a primary operator, as defined by TPDES General Permit, shall certify one Construction Site Notice (CSN) and provide this to Harris County at the time that the contract is awarded.** Harris County (owner), as primary operator**, as defined by TPDES General Permit**, shall certify a second Construction Site Notice (CSN) at the time

the contract is awarded. After the project is awarded, Harris County shall provide copies of the two certified Construction Site Notices (CSN) to the Contractor, and send copies to the local storm sewer operator for notification purposes. Prior to commencing construction activities, the Contractor shall laminate and post the notices on the project site in a location where they are readily available for public viewing. The Contractor shall maintain the posted notices until after completion of the construction activities and final stabilization of the project site as defined by the TPDES General Permit. When the project is completed and stabilization is achieved, as defined by the TPDES General Permit, then the Contractor shall note the date that the Small Construction Site Notice was removed from the project site. A copy of the completed Small Construction Site Notice shall be provided to the Engineer with the SWPPP records. The County shall then notify the local storm sewer operator that storm water associated with construction activities is no longer being discharged from the site.

or

3. "**Large Construction Sites**"

The project disturbs 5 acres or greater (or is part of a common plan of development with the potential to disturb 5 acres or more); therefore, coverage under the TPDES General Permit is required. The Contractor shall implement, inspect, and maintain the Storm Water Pollution Prevention Plan shown in the plans and project manual. Certification of a Notice of Intent (NOI) in accordance with Part II.E.3 of the TPDES General Permit is required and shall be completed in accordance with Harris County Specification Item Number 700. The Contractor shall not commence with any earth disturbing activities on the project site until:

- at least seven (7) days after submittal of the NOI (Harris County & Contractors) via U.S. Postal Service, or if Utilizing electronic submittal, prior to commencing construction activities,
- copies of signed NOI's are submitted to any municipal separate storm sewer system (MS4) receiving discharge, at least seven (7) days prior to commencing construction activities. Contractor shall list in the SWPPP the names and addresses of all MS4 operators receiving a copy.
- copies of the Certified NOI's are posted in a publicly accessible location (copies shall be laminated or placed in weather resistant display case),
- and copies (Harris County & Primary Contractors) of construction site notice for large sites (CSN) are posted in a publicly accessible location. After construction activities are complete and final stabilization is achieved (as defined by the TPDES General Permit), the Contractor shall certify one Notice of Termination (NOT) form and provide it to Harris County. Harris County shall certify a second NOT form. Harris County shall submit the two NOTs to the TCEQ and the local storm sewer system operator. After the NOTs have been submitted to the TCEQ, then the Contractor shall remove all temporary SWPPP controls, cease SWPPP inspections, and deliver copies of all SWPPP records to the Engineer who shall archive them

for a minimum of three years. The final payment to the Contractor may be held until all SWPPP records are received by the Engineer.

SECTION 2. STORM WATER QUALITY MANAGEMENT PLANS

A. COVERAGE

If this project meets the definition of "new development" or "significant redevelopment" as defined in the Harris County regulations or City of Houston ordinance on storm water quality and the project is not "grandfathered" or "exempt" as defined by the regulation or ordinance, then a Storm Water Quality Management Plan (SWQMP) is required for the project, as shown in the construction plans.

B. CLASSIFICATION

This project is classified as one of three categories listed below. The Contractor shall be responsible for the storm water quality items, accordingly.

1. "**SWQ Permit Within Unincorporated Harris County**"

   If a Storm Water Quality Management Plan with permanent storm water quality controls is shown in the construction plans and the project is located in unincorporated Harris County, then a *Storm Water Quality Management Plan* is required prior to the start of construction. Prior to the start of construction, the Engineer shall submit the plans and Written Storm Water Quality Management Plan to the Harris County Permits Group and obtain the *necessary signatures acknowledging acceptance of the Storm Water Quality Management Plan.* The Contractor shall construct the SWQMP structural controls in accordance with the construction plans, and maintain the SWQMP structural controls until completion of the project and until the Engineer can certify that the SWQMP structural controls are constructed in accordance with the plans.

or

2. "**SWQ Permit Within City of Houston**"

   If a Storm Water Quality Management Plan with permanent storm water quality controls is shown in the construction plans and the project is located in the jurisdiction of the City of Houston, then a *Storm Water Quality Management Permit* is required prior to the start of construction. Prior to the start of construction, the Engineer shall submit to the City of Houston the construction plans, the *City of Houston Storm Water Quality Management Plan Application for Permit*, and all other related documents shown on the permit application and obtain the *Storm Water Quality Management Permit.* **Prior to the start of construction, the Contractor shall post a performance bond to the City of Houston for the construction of the storm water quality structural controls.** The Contractor shall post a copy of the issued permit on the project site, construct the SWQMP structural controls in accordance with the construction plans, and maintain the SWQMP structural controls until completion of the project and until the Engineer can certify that the SWQMP structural controls are constructed in accordance with the plans.

The Engineer shall submit the *Storm Water Quality Permit As-built Certificate* to the City of Houston and Harris County shall begin implementation of the SWQMP.

or

3. "**Grandfathered or Exempt from SWQ Permit**" or "Storm Water Quality Bank"
If a Storm Water Quality Management Plan, or permanent storm water quality feature, is not shown in the construction plans, then a *Storm Water Quality Management Permit* is not required prior to the start of construction because it is grandfathered, exempt, or has provided storm water quality measures through the Storm Water Quality Bank.

SECTION 3. OTHER ENVIRONMENTAL ISSUES

A. BIOLOGICAL ISSUES

In accordance with requirements under the federal Migratory Bird Treaty Act, if in the course of construction, a bird rookery, an identified special migratory bird habitat, or a nesting site is discovered on the project site, then the Contractor shall cease work in the area and immediately notify the Engineer.

In accordance with the Federal Endangered Species Act and the Texas Parks and Wildlife Code, if a biological mitigation plan for specially protected flora and fauna species has been provided within the construction plans, then the Contractor shall comply with all requirements noted within the plan.

B. WATERS OF THE UNITED STATES INCLUDING ADJACENT WETLANDS

In accordance with Section 404 and Section 401 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, waters of the United States including adjacent wetlands shall not be impacted by the Contractor unless a Department of the Army Permit has been obtained from the U.S. Army Corps of Engineers for the project.

If Harris County has obtained a Department of the Army Permit for this project, a copy of the permit is provided in the project manual. The Contractor shall comply with all requirements of the Department of the Army Permit. The Contractor shall not impact any waters of the United States and adjacent wetlands greater than the area and volume shown in the permit. If the Contractor impacts waters of the United States including adjacent wetlands on the project site that exceeds the area and volume shown in the permit, then the Contractor shall be responsible for any violations that may be issued by the regulatory agencies. If the Contractor deems it necessary to impact waters of the United States including adjacent wetlands that exceed the permit, then the Contractor must first notify the Engineer and the Engineer may obtain the necessary regulatory clearances prior to allowing the additional impacts to occur.

During construction of the project, if the Contractor uses off-site areas (not owned by Harris County) for placement of borrow material, disposal of construction debris, staging of construction materials, usage as a field office, or other types of construction related activities, then the Contractor shall be solely responsible for obtaining all environmental permits for the off-site activity, as well

as providing all environmental controls and compensatory mitigation requested by the permitting agency. If a regulatory violation occurs as a result of this off-site activity, then the Contractor shall be solely responsible for this violation.

C. STATE OWNED SUBMERGED LANDS

The Contractor shall not impact submerged lands regulated under the authority of the Texas General Land Office, or other local agency, without an easement agreement. If an easement agreement is necessary for the construction activities, then the easement agreement shall be obtained by Harris County.

D. CULTURAL RESOURCES

In accordance with the National Historic Preservation Act and the Antiquities Code of Texas, the Contractor shall not remove or disturb, or cause or permit to be removed or disturbed, any historical, archeological, architectural, or other cultural artifacts, relics, vestiges, remains, or objects of antiquity from the project site. In the event that such items are discovered on the project during construction activities, the Contractor shall immediately notify the Engineer. The site and the potentially significant material shall be protected by the Contractor from further disturbance until a professional examination of them can be made and/or until clearance to proceed with construction has been provided by the Engineer.

E. HAZARDOUS AND PETROLEUM SUBSTANCES

If during the course of construction, the Contractor discovers hazardous or petroleum substances or wastes on the project site, then the Contractor shall immediately cease work in the area and remove all personnel from the area. The contractor shall temporarily close the area to the public, as well; temporary fencing or caution tape shall be installed around the area. The Contractor shall notify the Engineer immediately. Work in the area shall not be permitted until the Engineer has determined that safety and environmental issues have been properly addressed.

If a new "Service Outlet Location" is required from Centerpoint Energy, insert here, delete this sheet, and reestablish bookmark. Otherwise, delete this sheet.

Insert Architectural Specifications

(1) Insert all specifications and delete this page.
(2) Establish the bookmark.

HARRIS COUNTY DISTRICT ATTORNEY
BUILDING DEMOLITION AND SITE IMPROVEMENTS
201 FANNIN STREET | HOUSTON TEXAS | 77002

PROJECT NO. : 17-00017-00

11.17.2017

STATE OF TEXAS
RICHARD QUINTANILLA
101236
LICENSED PROFESSIONAL ENGINEER
11.16.17

Henderson Rogers
Structural Engineers, LLC
TBPE Firm Registration No. 8755

STATE OF TEXAS
MADISON H. HENDERSON
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STATE OF TEXAS
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REGISTERED LANDSCAPE ARCHITECT
MICHAEL P. MAUER
1510
STATE OF TEXAS
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STATE OF TEXAS
KEN STANLEY
69701
LICENSED PROFESSIONAL ENGINEER
11/14/17
For Civil Site Work Only

Issue for Construction
PROJECT MANUAL

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17 November 2017

SECTION 00 01 10

TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING DOCUMENTS GROUP

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

SPECIFICATIONS GROUP

General Requirements Subgroup

DIVISION 01 – GENERAL REQUIREMENTS

Facility Construction Subgroup

DIVISION 02 – EXISTING CONDITIONS

DIVISION 13 – SPECIAL CONSTRUCTION

NOT APPLICABLE

DIVISION 14 - CONVEYING EQUIPMENT

NOT APPLICABLE

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

DIVISION 26 – ELECTRICAL

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

33 41 00 STORM UTILITY DRAINAGE PIPING

END OF SECTION

DOCUMENT 00 31 32

GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its attachment is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

END OF DOCUMENT

RABA KISTNER CONSULTANTS

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TBPE Firm F-3257

Project No. AHA17-083-00
August 23, 2017

Mr. Michael K. Jrab, AIA, LEED BD+C
Johnston LLC
2603 Augusta, Suite 1500
Houston, Texas 77057

RE: Geotechnical Consulting Services
Harris County District Attorney Building Demolition and Site Surface Improvement
Houston, Texas

Dear Mr. Jrab

Raba Kistner Consultants, Inc. (RKCI) is pleased to submit our letter report for the above-referenced project. This study was performed in accordance with **RKCI** Proposal No. PHA17-110-00, dated July 27, 2017. Written authorization to proceed with this study was received with the *Subcontract for Professional Services between Architect and Consultant* dated August 10, 2017. This report presents our recommendations for basement backfilling and pavement subgrade and thickness design and construction considerations.

PROJECT DESCRIPTION

It is our understanding that the project consists of the demolition of the Harris County District Attorney Building located at 201 Fannin Street in Houston, Texas. On the basis of information provided, the structure was built in 1936, and consists of a 10 story building with one basement level. Following demolition, the basement level will be backfilled up to street level, and then the site will be developed into an interim surface parking lot with concrete pavement.

The following sections present our recommendations for filling the basement level, which may include the use of select fill, flowable fill, cement stabilized sand, debris from the demolition or a combination thereof, and pavement subgrade preparation and concrete pavement design.

BASEMENT BACKFILL

We have assumed the existing basement walls and floor will remain in place during backfilling. Any water in the basement should be removed prior to backfilling. We recommend backfilling approximately two-thirds of building basement with demolition debris such as bricks and/or concrete, or other incompressible material such as cement treated sand or flowable fill. Brick/concrete pieces should have a maximum size not exceeding 6-inches and should be placed in maximum 24-in thick lifts and compacted using a vibratory steel drum or falling weight. However, if basement walls are shared with an adjacent basement, flowable fill should be used in lieu of compacted fill to avoid damaging the below grade walls. Fill compacted against walls will create vertical and horizontal stresses. If the wall is free standing with open space behind it, the horizontal pressure acting on the wall might cause the wall to fail.

If a ramp cannot be constructed to transport compaction equipment from surface level to the bottom of the basement, flowable fill could be used to initially infill the basement. Flowable fill mix design,

placement, and quality control should be performed in accordance with *City of Houston Standard Specification* 02322. We recommend a maximum unconfined compressive strength of 300 psi to allow for future excavation.

Flowable fill may be discontinued once fill height has reached a level where compaction equipment can be used. Properly prepared construction debris (bricks, concrete, and glass) can then be placed into the basement and compacted in controlled lifts as discussed previously.

Cement stabilized sand or select fill should be used for the final 18-inches of backfill in order to provide a firm, level platform for pavement construction. Cement stabilized sand design requirements and placement guidelines should be in accordance with *City of Houston Standard Specification* Section 02321. Cement stabilized sand should be placed in lifts not exceeding 12-inches and compacted to minimum 95 percent of ASTM D558. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours. Provide no less than 1.1 sacks of cement per ton of dry sand.

Materials used as select fill for final site grading preferably should be inert cohesive/semi-cohesive sandy lean clays (CL)/clayey sands (SC) as classified according to the USCS, may be considered satisfactory for use as select fill materials at this site. Select fill materials shall have a maximum liquid limit not exceeding 40 percent, a plasticity index between 7 and 20 percent, and a maximum particle size not exceeding 4 in. or one-half the loose lift thickness, whichever is smaller. In addition, if these materials are utilized, grain size analyses and Atterberg Limits must be performed during placement at a minimum rate of one test each per 5,000 cubic yards of material due to the high degree of variability associated with pit-run materials.

Select fill should be placed in loose lifts not exceeding 8 in. in thickness and compacted to at least 95 percent of maximum density as determined by ASTM D 698. The moisture content of the fill should be maintained within the range of 2 percentage points below to 2 percentage points above the optimum moisture content until final compaction.

PAVEMENT SUBGRADE PREPARATION

SITE PREPARATION

Areas outside the basement area should be stripped of all existing pavement and underlying base material, or other deleterious materials. After stripping and grubbing, the exposed subgrade should be thoroughly proofrolled in order to locate and densify any weak, compressible zones. A minimum of 5 passes of a fully-loaded dump truck or a similar heavily-loaded piece of construction equipment should be used for planning purposes. Proofrolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proofrolling should be removed and replaced with suitable, compacted on-site clays, free of organics, oversized materials, and degradable or deleterious materials.

FILL PLACEMENT

Fill required for grading should be imported select fill free of organic matter and excessive silt, and compacted in conformance with the requirements presented previously on this page for select fill.

PAVEMENT CONSTRUCTION AND DESIGN RECOMMENDATIONS

RIGID PAVEMENT

Concrete pavement design for parking lots was performed in accordance with the American Concrete Institute (ACI) *Guide for Design and Construction of Concrete Parking Lots* (ACI Committee 330R-01). Based on an effective modulus of subgrade reaction (k) value of 200 pci, a concrete flexural strength of 500 psi, and the concrete thickness tables presented in Table 2.4 of ACI 330R, design concrete thicknesses for light duty, medium duty, and heavy duty pavement are presented below.

- Light Duty Pavement (Car Parking Areas, Traffic Category A, ADTT = 0), concrete design thickness = 5 inches.
- Medium Duty Pavement (Drive Aisles, Traffic Category A-1, ADDT = 10), concrete thickness = 6 inches.
- Heavy Duty Pavement (Driveways, Dumpster Areas and Truck Docks, Traffic Category C, ADTT = 300), concrete design thickness = 7 inches.

ADTT = average daily truck traffic. Trucks are defined as vehicles with a t least six wheels; excludes panel trucks, pickup trucks, and other four-wheel vehicles. Traffic Category C = Single units (bobtailed trucks). Traffic Category D = Multiple units (tractor trailer units with one of more trailers).

Using the previously referenced modulus of subgrade reaction value and the foregoing traffic volumes, the following rigid pavement reinforcement is recommended.

Maximum Individual Slab Dimension (Expansion Joint to Crack Control Joint)	= 12.5 feet by 12.5 feet (light duty)
Maximum Individual Slab Dimension (Expansion Joint to Crack Control Joint)	= 15 feet by 15 feet (heavy duty)
Reinforcement Size	= No. 3 Deformed Bars
Reinforcement Spacing	= 18 inches on-centers each way
Load Transfer at Joints, Dowel Size	= 3/4-inch diameter smooth bars
Load Transfer at Joints, Dowel Length	= 24 inches (one end treated to slip)
Load Transfer at Joints, Dowel Spacing	= 12 inches on-centers along each joint

Traffic conditions are expected to vary at the site, with heavy traffic loads anticipated for the entrance drives and lighter traffic loads throughout the parking areas.

EXPANSION JOINTS

Expansion joints will be required along the basement perimeter to offset the effects of expected differential movements. Expansion joints are full depth, vertical joints usually filled with a compressible material. Horizontal dowels or reinforcement steel are required to create a minimum 10-inch overlap of reinforcing steel when making a connection between pavement overlying the basement and pavement outside the basement area. We recommend the use of dowels to transfer loads across the expansion joint. Horizontal dowels shall be Grade 60 bars, 24-inches long, drilled and embedded 12-inches into the center of the existing slab. Dowels shall be 12-inches center-to-center, unless otherwise specified.

DRAINAGE CONSIDERATIONS

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the pavement subgrade and/or the supporting granular pavement materials will greatly reduce the performance and service life of the pavement systems.

Surface and subsurface drainage considerations crucial to the performance of pavements at this site include (but are not limited to) the following:

- Any known natural or man-made subsurface seepage at the site which may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade drains;
- final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. Curbs should be installed to sufficient depth to reduce infiltration of water beneath the curbs, and;
- pavement surfaces should be maintained to help reduce surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

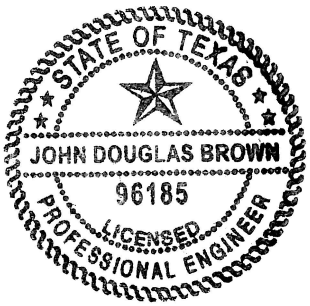
CLOSING

We appreciate the opportunity to be of professional service to you on this project and look forward to receiving your comments. Should you have any questions about the information presented in this report, please call.

Very truly yours,
RABA KISTNER CONSULTANTS, INC.

John D. Brown

John D. Brown, P.E.
Manager, Geotechnical Services
JDB/dar



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SECTION 01 01 00

SUMMARY OF WORK

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. In the event that the provisions of this Section may be in conflict with requirements of the Contract Conditions or provisions of other Sections in the Specifications, the most stringent requirements will apply as determined by Harris County Engineering Dept.

1.2 DESCRIPTION OF WORK

A. The purpose of this Contract is for the Contractor to furnish all labor, equipment, materials, and incidentals necessary to provide for demolition of District Attorney building, construction of a surface parking lot, removal of the overhead enclosed pedestrian bridge and providing new enclosure of the opening at the Harris County Facility building to match existing construction, all complete, operational and in place in accordance with the Contract Documents.

B. In the event of conflicts within the construction documents not clarified by addendum, the Contractor shall provide the better quality or greater quantity of work.

C. The Contractor shall submit a critical path method (CPM) type schedule showing the sequence of installation for the various components of the work Division 01 Section "Construction Progress Documentation". The construction schedule shall be updated by the Contractor whenever the schedule is impacted.

D. Schedule of Values: Submit according to Division 01 Section "Payment Procedures" and as follows:

1. The schedule of values may contain separate pay items for Division 01 requirements on bonding and insurance. All other costs shall be prorated across each line item of work.
2. On projects over $500,000.00 the schedule of values shall be divided into labor and material for each line item of work.

E. Permits: The Contractor shall obtain and pay for all construction-related permits, utility taps, and hook-ups. No additional compensation will be made for time associated with the permit process.

F. A full time designated field superintendent with a minimum of eight (8) years experience

in similar construction types must be present at all times that work is in progress, and must be capable of making decisions on the Contractor's behalf. If the field superintendent is absent for any part of any day that work is being performed, then $150.00 per day (for each such occurrence) will be back charged to the Contractor and deducted from the estimate. Repetitive occurrences could be grounds for notifying the bonding company.

G. The Contractor must submit a list of all subcontractors prior to commencing work. During the course of this project, the Architect must be notified of any changes in subcontractors.

H. Field Office: The Contractor shall have the use of space in existing Harris County Facility and this office shall be complete in place and fully furnished and operational within 45 calendar days from the signing of the purchase order. Failure to have a fully furnished and operational field office within the allotted 45 calendar days will result in liquidated damages being assessed against the contract in the amount of fifty dollars ($50.00) per day for each day that the field office is not fully operational. The term fully operational shall include but not be limited to: all required utility connections, required furnishings and climate control. Refer to Division 01 Section “Temporary Facilities and Controls” for additional requirements.

PART 2 - PROSECUTION OF THE PROJECT

2.01 TASKS

A. Temporary Facilities: Refer to Division 01 Section “Temporary Facilities and Controls” for requirements.

B. Parking: The Contractor shall be responsible for the parking of his vehicles in a legal manner at no additional expense or inconvenience to Harris County.

C. Storage: The Contractor shall be fully responsible for the security and safe keeping of any stored materials according to Division 01 Section “Product Requirements” and as follows:

1. In addition to manufacturer’s recommendations, deliver, store, and handle products using materials, means, and methods that shall prevent mildew and mold growth.
2. The Contractor may use proximate open areas of the site for storage of materials at his own risk. Storage areas must be approved by the Architect.
3. The Contractor may not use any existing part of any existing Harris County building for storage of materials unless approved in writing to do so by the Architect.
4. Remote - The Contractor may use a location "on" or "off" the job site for storage of materials. However, if he intends to submit requests for payment for stored materials, then Harris County, at its discretion, may pay for actual cost of material

stored (less stipulated retainage) under the following conditions:

a. The Contractor shall apply for and receive advanced written approval from the Architect.
b. The intended location must be judged suitable and secure by the Architect.
c. The storage shall be in a bonded warehouse, in Harris County's name, fully insured.
d. The Contractor shall pay all costs related to the storage including loading, unloading, transportation, warehouse rent, and insurance.
e. The quantity and quality of material shall be inspected by the Architect, to ascertain compliance with the Contract Documents, paid invoices, and materials list.

D. Hours of Work:

1. The Harris County Facility building/site will be occupied by Harris County during the course of the project. The District Attorney building/site will be vacated prior to start of Work.
2. The Contractor shall limit all construction activity to the following times: 7:00 a.m. to 4:00 p.m., Monday through Friday. In addition, work on elevated floor of Harris County Facility building shall coordinate and work around scheduled court sessions.
3. If it becomes necessary to work on weekends, holidays, and after the hours noted above, a written request to work shall be submitted for approval to the Manager of Architectural Construction Section, twenty-four (24) hours prior to performing the work. Access to the site during these hours shall be coordinated through the Chief Inspector.
4. Work shall be performed so as to not interfere with normal activities occurring outside the work area.
5. Rain Days:

a. Building Projects – If inclement weather (as defined in the General Conditions Article 5) impacts any portion of the project such that the project completion date is delayed (regardless of whether work is being performed on any other scheduled portion of the project during that time), then that day shall be deemed an Inclement Weather Day or Rain Day.

E. Work Commencement: The Contractor shall notify the Inspector forty-eight (48) hours prior to starting or restarting work on the project.

F. Cover-up Inspection: The Contractor shall notify the Inspector a minimum of forty-eight (48) hours prior to any cover-up inspection. Any work covered-up prior to inspection and sign off shall be considered non-conforming to contract requirements.

G. Wage Scale Posting: The Contractor shall post the wage scale at all times at the site of

work in a prominent place where it can be easily seen by the workers in the field office.

H. Pay Estimate Posting: The most current processed monthly pay estimate for the project shall be posted at the site of work in a prominent place where it can be easily seen by the subcontractors in the field office.

PART 3 - CONTRACT ADMINISTRATION

3.01 PROCEDURES

A. Clarifications: All clarifications required by the Contractor shall be requested in an expeditious manner from the Architect in the written form of a Request for Information (RFI). The Contractor shall copy Harris County Engineering Dept. on all RFI documents. No additional compensation to the Contractor will be allowed for delays resulting from late requests for clarifications. Responses to RFI's will not be binding on Harris County until confirmed in writing by the Architect. Refer to Division 01 Section “Project Management and Coordination” for additional requirements.

B. Field Modifications: No person shall have the authority to verbally alter the requirements of the contract documents. No field modifications will be binding on Harris County unless confirmed in writing from the Architect, or documented, signed and dated by the Architect on the set of "Record Drawings" in the field office.

C. Changes in Contract: In addition to requirements specified in Division 01 Section “Contract Modificatioin Procedures” comply with the following:

1. All proposed costs for a change in contract must be supported by itemized accounting of material, equipment and labor in sufficient detail to allow value analysis by the Architect using current cost estimating guides prevalent in the area. Harris County shall have up to fourteen (14) calendar days from date of receipt of written proposal for review and approval by the Architect.
2. For general construction work, the Contractor will be allowed the actual cost for materials from supply houses, the total amount of wages paid for labor, and the total cost of Federal Old Age Benefits (Social Security Tax) and of Worker's Compensation and Public Liability Insurance, plus cost of Bond if the size of the change warrants revision of the bonds. To the total of the above costs, the Contractor will be allowed to add a percentage as noted below to cover overhead and profit combined. Overhead shall be considered to include insurance other than mentioned herein, field and office supervisors, Project Managers and assistants, clerical work, use of small hand tools, incidental job burdens (i.e. telephone, electricity, dumpster costs) and general home office expense, and no separate allowance will be made therefor. Allowable percentages for overhead and profit on changes shall not exceed 15%. In no way shall the cumulative cost burden to Harris County for overhead and profit exceed 15% including the General Contractor and his Subcontractors combined.

3. On changes involving both additions and deletions, percentages for overhead and profit will be allowed only on the net addition.

D. Separate Construction by Harris County: Harris County may administer separate construction contract(s) on this project site simultaneously. Harris County may coordinate the separate contracts and the Contractor shall extend full cooperation towards successful execution of all separate contracts.

E. Preservation and Restoration of Property: Harris County reserves the right to repair damages to existing property made necessary through an act, omission or misconduct, or in consequence of the non-performance of the Work on the part of the Contractor, his employees or subcontractors, if the Contractor fails to respond to written demand for the repair within 24 hours of such notification. Repairs made by the County on the Contractor's behalf shall be reimbursed by the Contractor to the County or said costs of repairs may be deducted from amounts owed to the Contractor.

F. Commissioning: Commissioning of the facility shall occur prior to substantial completion. The commissioning process shall include representatives from the Design Team, Contract Administration and County Agencies responsible for the operation and maintenance of the facility.

G. Substantial Completion: Substantial Completion occurs when the project can be occupied and used for its intended purpose. Substantial completion occurs when all mechanical, electrical and plumbing systems and fixtures are operational and the building or portion of the building can be occupied for its intended purpose. Factors such as the lack of door hardware, security features, life safety devices, fire and smoke alarm testing, and too many other aspects too numerous to list may mitigate against a project being substantially complete for the purpose of stopping the contract time. The Architect shall issue a substantial completion certificate setting forth a time limit for remedying the punch list items, as determined by the Architect. The substantial completion certificate effectively stops the contract time. Failure of the Contractor to complete punch list items within the time limit shall result in the assessment of liquidated damages being assessed against the contract in an amount equal to one half of the liquidated damages applicable to delays prior to substantial completion. Warranty periods and dates for the owner to assume responsibility for utilities, shall be the date of substantial completion.

1. Refer to Division 01 Section "Closeout Procedures" for additional requirements.

H. Warranties:

1. All items having a manufacturer's warranty installed under this contract shall be installed by or under the directive of the manufacturer or his certified agent in order to conform with the manufacturer's warranty requirements. All work involving manufacturer's products shall be performed in accordance with manufacturer's recommendations in order to maintain all warranties.

2. Immediately prior to expiration of the one (1) year standard warranty period, or any extended warranty, the Contractor shall make an inspection of the Work in the company of the Architect. The Architect shall be given not less than fourteen (14) calendar days notice prior to the anticipated date of warranty expiration.
3. Where any portion of the Work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective Work and shall prosecute such Work without delay until completed to the satisfaction of the Architect, even though the date of completion of the corrective work may extend beyond the expiration date of the warranty period.

END OF SECTION

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

B. Related Sections include Division 01 “Temporary Facilities and Controls” for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Harris County District Attorney Building Demolition and Site Improvements.

1. Project Location: 201 Fannin Street, Houston, Texas, 77002.

B. Owner: Harris County, Harris County Texas.

1. Harris County Construction Programs Project Manager: Richard Arrendell.

a. Address: Harris County Engineering Department, 1001 Preston, 7th Floor, Houston, Texas 77002.
b. Telephone: (713) 755-7630.

C. Architect: Johnston, LLC.

1. Address: 2603 Augusta Drive, Suite 1500, Houston, Tx 77057. Phone: (713) 244-8300
3. Contact: Michael Jrab, AIA, LEED AP BD+C

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of demolition of District Attorney building, construction of a surface parking lot, removal of the overhead enclosed pedestrian bridge and providing new enclosure of the opening at the Harris County Facility building to match existing construction.

B. Type of Contract. Project will be constructed under a single prime contract.

C. Comply with applicable portions of Harris County Standard Engineering Design Specifications – 9-1-17. It can be downloaded from the Harris County Engineering web site. http://www.eng.hctx.net

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

A. Partial Occupancy: Tenants of the building will occupy the premises on other floors adjacent to the areas under construction during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours permitted by building management unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.
3. Comply with City of Houston noise ordinance for work at DA building demolition and new parking surface areas.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words “shall,” “shall be,” or “shall comply with,” depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections include Division 01 Section “Product Requirements” for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify 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 to which Architect has no objection.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination 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 substitution with those of the Work specified. Include annotated copy of 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. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. 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.
m. 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. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven 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 does not issue a decision on use of a proposed substitution within time allocated.

1.4 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 manufacturers.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Requested substitution will not adversely affect Contractor's construction schedule.
    c. Requested substitution has received necessary approvals of authorities having jurisdiction.
    d. Requested substitution is compatible with other portions of the Work.
    e. Requested substitution has been coordinated with other portions of the Work.
    f. Requested substitution provides specified warranty.
    g. 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: Architect will consider requests for substitution if received within 60 days after the Notice of Award.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

    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.
    d. Requested substitution will not adversely affect Contractor's construction schedule.
    e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    f. Requested substitution is compatible with other portions of the Work.
    g. Requested substitution has been coordinated with other portions of the Work.

h. Requested substitution provides specified warranty.
i. 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 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 “Substitution Procedures” if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include:

1. Division 01 Section “Contract Modification Procedures” for administrative procedures for handling changes to the Contract.
2. Division 01 Section “Construction Progress Documentation” for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Owner's project number.
e. Contractor's name and address.
f. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the schedule of values and Applications for Payment shall be complete.
8. Include total cost and proportionate share of general overhead and profit for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered

by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Schedule of unit prices.
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.

9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.

H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, “Contractor's Affidavit of Payment of Debts and Claims.”
5. AIA Document G706A-1994, “Contractor's Affidavit of Release of Liens.”
6. AIA Document G707-1994, “Consent of Surety to Final Payment.”
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project meetings.

B. Related Sections include Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on the Drawings. Specifically note dimensions

that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
4. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIS)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI using Architect's Newforma project management software.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Owner's project number.
4. Date.
5. Name of Contractor.
6. Name of Architect.
7. RFI number, numbered sequentially.
8. RFI subject.
9. Specification Section number and title and related paragraphs, as appropriate.

10. Drawing number and detail references, as appropriate.
11. Field dimensions and conditions, as appropriate.
12. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
13. Contractor's signature.
14. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: Software-generated form using Architect's Newforma project management software.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.

4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after issurance of the P.O.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Critical work sequencing and long-lead items.
c. Designation of key personnel and their duties.
d. Procedures for processing field decisions and Change Orders.
e. Procedures for RFIs.

f. Procedures for testing and inspecting.
g. Procedures for processing Applications for Payment.
h. Distribution of the Contract Documents.
i. Submittal procedures.
j. Preparation of record documents.
k. Use of the premises and existing building.
l. Work restrictions.
m. Working hours.
n. Owner's occupancy requirements.
o. Responsibility for temporary facilities and controls.
p. Procedures for moisture and mold control.
q. Procedures for disruptions and shutdowns.
r. Construction waste management and recycling.
s. Parking availability.
t. Office, work, and storage areas.
u. Equipment deliveries and priorities.
v. First aid.
w. Security.
x. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.

m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded.
   Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

   a. Contractor's Construction Schedule: Review progress since the last meeting.

      1) Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      2) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or

recognized. Issue revised schedule concurrently with the report of each meeting.

E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 45 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; m ajor subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Coordination of separate contracts.
    k. Owner's partial occupancy requirements.
    l. Installation of Owner's furniture, fixtures, and equipment.
    m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in PDF electronic file format using Architect's Newforma project management software.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports.

D. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date,late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section “Submittal Procedures” in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
2. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.

g. Seasonal variations.
h. Environmental control.

3. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

3. Use “one workday” as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing.
    j. Punch list and final completion.
    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight “early start-total float.” Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.

17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.

b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

C. Printed Photographs: Submit two sets of prints of each photographic view within seven days of taking photographs.

1. Format: 8-by-10-inch (203-by-254-mm) smooth-surface matte prints on single-weight, paper; enclosed back to back in clear plastic sleeves punched for three-ring binder. Include copy of key plan indicating each photograph's location and direction. Provide one binder for each set of prints.
2. Identification: On back of each print, label with the following information:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken if not date stamped by camera.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

D. Video Recordings: Submit video recordings within seven days of recording. Comply with Harris County Item No. 561, unless more stringent requirements specified herein.

1. Submit video recordings on CD-ROM or thumb drive. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information in file metadata tag:

a. Name of Project.
b. Name and address of photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

3. Transcript: Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover

sheet with label information. Include name of Project and date of video recording on each page.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.

C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Metadata: Record accurate date and time and GPS location data from camera.

E. File Names: Name media files with date, and Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of excavation, commencement of demolition, starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 20 photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, on the same day each week.
2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:

    a. Commencement of the Work, through completion of subgrade construction.
    b. Above-grade structural framing.
    c. Exterior building enclosure.
    d. Interior Work, through date of Substantial Completion.

F. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

G. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.

c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
d. Substantial Completion of a major phase or component of the Work.
e. Extra record photographs at time of final acceptance.

1.6 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.

B. Narration: Describe scenes on video recording by audio narration by microphone while or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.

1. Confirm date and time at beginning and end of recording.
2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.

C. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.

D. Preconstruction Video Recording: Before starting demolition and construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.

1. Flag excavation areas and construction limits before recording construction video recordings.
2. Show existing conditions adjacent to Project site before starting the Work.
3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of excavation, demolition, construction.
4. Show protection efforts by Contractor.

E. Periodic Construction Video Recordings: Record video recording weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).

F. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.

1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:

    a. Commencement of the Work, through completion of subgrade construction.
    b. Above-grade structural framing.
    c. Exterior building enclosure.

2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight hours.
3. Vantage Points: Following suggestions by Architect and Contractor, photographer shall select vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include:

1. Division 01 Section “Construction Progress Documentation” for submitting schedules and reports, including Contractor's construction schedule.
2. Division 01 Section “Operation and Maintenance Data” for submitting operation and maintenance manuals.
3. Division 01 Section “Project Record Documents” for submitting record Drawings, record Specifications, and record Product Data.
4. Division 01 Section “Demonstration and Training” for submitting prerecorded video recordings used in demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Paper Submittals: Not permitted unless otherwise indicated.

B. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.

d. Product name.

C. Options: Identify options requiring selection by Architect.

D. Deviations: Identify deviations from the Contract Documents on submittals.

E. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

F. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

G. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals using Architect’s Newforma project management software.
2. Paper Copies: Not permitted unless otherwise indicated.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in PDF electronic file format using Architect's Newforma project management software.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Submit Shop Drawings in PDF electronic file formal using Architect's Newforma project management software.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality- control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified physically identical with material or product proposed for use,

and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufacture or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit four sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in PDF electronic file format.

F. Coordination Drawings Submittals: Comply with requirements specified in Division 01 Section “Project Management and Coordination.”

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section “Construction Progress Documentation.”

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section “Payment Procedures.

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section “Quality Requirements.”

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section “Closeout Procedures.”

K. Maintenance Data: Comply with requirements specified in Division 01 Section “Operation and Maintenance Data.”

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and

personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

U. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section “Quality Requirements.”

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit written reports indicating and interpreting results of field

tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section “Closeout Procedures.”

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract

Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for re-submittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.

1. Attendees: Representatives of Owner, Architect, Contractor, and building management shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:

    a. Fire-prevention plan.
    b. Governing regulations.
    c. Areas where existing construction is to remain and the required protection.
    d. Hauling routes.
    e. Sequence of alteration work operations.
    f. Storage, protection, and accounting for salvaged and specially fabricated items.
    g. Existing conditions, staging, and structural loading limitations of areas where materials are stored.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.4 QUALITY ASSURANCE

A. Alteration Work Program: Prepare a written plan for alteration work for whole Project,

including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise- control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Comply with City of Houston noise ordinance at DA Building and parking surface areas.
3. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers, and including proposed collection systems.

B. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

C. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.5 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

B. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

C. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or

photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
   a. Protection from falling debris to adjacent buildings shall be provided.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled “Owner's Responsibility for Fire Protection.”
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.

3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
    e. Maintain fire-watch personnel at Project site until 60 minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

    1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals

selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs.

B. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

C. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, 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.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both.

I. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

K. Experienced: When used with an entity or individual, “experienced” means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum

within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

B. Testing Agency Qualifications: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Texas and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as

documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    d. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

1.7 QUALTITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract
5. Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract

Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the

responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work.
7. Tests shall include the following:

    a. Subgrade
    b. Concrete: Paving, Slab and Sidewalk
    c. Steel: Bolts and welds
    d. Other testing specified.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's “Encyclopedia of Associations: National Organizations of the U.S.” or in Columbia Books' “National Trade & Professional Associations of the United States.”

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. DIN Deutsches Institut fur Normung e.V.
2. IAPMO International Association of Plumbing and Mechanical Officials
3. ICC International Code Council
4. ICC-ES ICC Evaluation Service, LLC

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE Army Corps of Engineers
2. CPSC Consumer Product Safety Commission
3. DOC Department of Commerce, National Institute of Standards and Technology DOD Department of Defense
4. DOE Department of Energy
5. EPA Environmental Protection Agency
6. FAA Federal Aviation Administration
7. FG Federal Government Publications

8.	GSA	General Services Administration
9.	HUD	Department of Housing and Urban Development
10.	LBL	Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division
11.	OSHA	Occupational Safety & Health Administration
12.	SD	Department of State
13.	TRB	Transportation Research Board. National Cooperative Highway Research Program
14.	USDA	Department of Agriculture, Agriculture Research Service, U.S. Salinity Laboratory
15.	USDA	Department of Agriculture, Rural Utilities Service
16.	USDJ	Department of Justice, Office of Justice Programs, National Institute of Justice USP U.S. Pharmacopeia
17.	USPS	United States Postal Service

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

1.	CFR	Code of Federal Regulations; available from Government Printing Office
2.	DOD	Department of Defense, Military Specifications and Standards; available from Department of Defense Single Stock Point
3.	DSCC	Defense Supply Center Columbus (See FS)
4.	FED-STD	Federal Standard (See FS)
5.	FS	Federal Specification: available from Department of Defense Single Stock Point, Defense Standardization Program, General Services Administration, or National Institute of Building Sciences/Whole Building Design Guide
6.	MILSPEC	Military Specification and Standards (See DOD)
7.	USAB	United States Access Board
8.	USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1.	CBHF	State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation
2.	CCR	California Code of Regulations, Office of Administrative Law, California Title 24 Energy Code
3.	CDHS	California Department of Health Care Services (Formerly: California Department of Health Services) (See CCR)
4.	CDPH	California Department of Public Health, Indoor Air Quality Program

5.	CPUC	California Public Utilities Commission
6.	SCAQMD	South Coast Air Quality Management District
7.	TDLR	Texas Department of Licensing and Regulation
8.	TDI	Texas Department of Insurance
9.	TFS	Texas Forest Service, Forest Resource Development and Sustainable Forestry

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include Division 01 Section “Summary” for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the "Texas Accessibility Standards" (TAS).

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Common-Use Field Office: Space will be available in the Harris County Facilities. Keep office clean and orderly.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: The Owner will make certain portions of the existing building available to the Contractor for field office facilities.

B. Storage and Fabrication Areas: The Owner will make available areas for the Contractor's use for storage and fabrication. Facilities to secure these areas are the Contractor's responsibility.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section “Closeout Procedures”.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Comply with “Cosmetic Wash Water Guidelines - Best Management Practices” published by the City of Houston Department of Public Works and Engineering for disposal of water from washing and cleaning operations.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction

for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: At structure demolition site provide required sanitary facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.

h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Submit traffic control plans for review. Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. Refer to Drawings for specific requirements for protection materials and personnel required.
4. Uniformed Traffic Control Officer: Monday thru Friday 7-10 am and 4-6 pm, a uniform officer shall be provided for traffic control at the intersection of Franklin and Fannin.

C. Parking: By Contractor’s own expense off the project site.

D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 01 Section

"Execution."

F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

G. Existing Elevators are out of order.

H. Existing Stair Usage: Use of Owner's existing stairs will not be permitted.

I. Noise Control: Comply with City of Houston. Follow the noise ordinance Section. 30-6 with maximum permissible sound levels for nonresidential property: 68 dB(A) at all times.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

I. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

K. Identification badges: Construction personnel shall wear identification badges showing each workers photo identification, at all times while on the Harris County Facility premises to allow entrance without going thru security. Owner's project manager

Coordinator will furnish a supply of numbered badges to the superintendent for each active construction project. The contractor's superintendent will be responsible for issuing badges to construction workers, maintaining a log of badge assignments, retrieving badges from workers who will not return to the project, and returning badges to the project Coordinator at completion of the project.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Discard or replace water-damaged and wet material.
4. Discard, replace, or clean stored or installed material that begins to grow mold.
5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section “Closeout Procedures.”

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Sections include Division 01 Section “Substitution Procedures” for requests for substitutions.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term “product” includes the terms “material,” “equipment,” “system,” and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words “basis-of-design product,” including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 Section “Submittal Procedures.”
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section “Submittal Procedures.” Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, harmful, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly

protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section “Closeout Procedures.”

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term “as selected,” Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in “Comparable Products” Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's

convenience will be considered.

b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.
2. Cutting and patching.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.

B. Related Sections include:

1. Division 01 Section “Summary” for limits on use of Project site.
2. Division 01 Section “Closeout Procedures” for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that

results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly.

C. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section “Project Management and Coordination.”

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing

products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels. Comply with City of Houston noise ordinance for work at DA Building and parking surface areas.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
   Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

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

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

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

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

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

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

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even- plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize harmful and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris to the greatest degree possible without delaying work.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not harmful to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section “Quality Requirements”

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Sections include:

1. Division 01 Section “Operation and Maintenance Data” for operation and maintenance manual requirements.
2. Division 01 Section “Project Record Documents” for submitting record Drawings, record Specifications, and record Product Data.
3. Division 01 Section “Demonstration and Training” for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
7. Submit cover letter to transfer utilities(including but not limited to electric service) from Contractor to Harris County.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section “Demonstration and Training.”
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section “Payment Procedures.”
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage

complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Submit final completion photographic documentation.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training prerecorded video recordings.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in PDF electronic file format. Architect will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8- 1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty.
3. Mark tab to identify the product or installation. Provide a typed description of the

product or installation, including the name of the product and the name, address, and telephone number of Installer.

4. Identify each binder on the front and spine with the typed or printed title
5. "WARRANTIES," Project name, and name of Contractor.
6. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially harmful to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning:Employ experienced workers or professional cleaners for final cleaning.

C. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean transparent materials, including glass in windows.
i. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment and similar equipment.
l. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
o. Leave Project clean and ready for occupancy.

D. Pest Control: Comply with pest control requirements in Section 015000 “Temporary Facilities and Controls.” Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces,

and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces.
3. Replace finishes and surfaces that that already show evidence of repair or restoration.

C. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

1. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
2. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available.
2. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
3. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. Identify each binder on front and spine, with printed title “OPERATION AND MAINTENANCE MANUAL,” Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate

locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.

3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish.Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of

equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data

indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Division 01 Section “Closeout Procedures” for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Product Data.

B. Related Sections include Division 01 Section “Operation and Maintenance Data” for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Initial Submittal: Submit one paper-copy set(s) of marked-up record prints.
2. Final Submittal:

   a. Submit PDF electronic files of scanned record prints and three set(s) of prints.
   b. Print each drawing, whether or not changes and additional information were recorded.

B. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.
c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on record prints.
3. Delete, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect for resolution.
5. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each record Drawing; include the designation “PROJECT RECORD DRAWING” in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation “PROJECT RECORD DRAWINGS.”
d. Name of Architect.

e. Name of Contractor.

2.2 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file and paper copy.

2.3 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Preproduced demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.3 CLOSEOUT SUBMITTALS

A. Preproduced demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section “Quality Requirements,” experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 “Operation and Maintenance Data.”

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 02 41 16

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Abandoning in-place below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place site utilities.
4. Salvaging items for reuse by Owner.

B. Related Sections:

1. Section 011000 "Summary" for use of the premises and phasing requirements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items

of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

B. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping of utility services.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

C. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

D. On-site storage or sale of removed items or materials is not permitted.

E. Hazardous Materials: It is not expected that hazardous materials (including asbestos) will be encountered in the Work.
1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

PART 2 - PRODUCTS[(Not Used)]

2.1 SOIL MATERIALS AND EXECUTION

A. Satisfactory Soils, Backfill, and Placement: Comply with project Geotechnical Report.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review available Project Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Documents.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

D. Perform an engineering survey of condition of building as required to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

3.2 PREPARATION

A. Existing Utilities: See plumbing and electrical Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

    a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 24 hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys as required to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade basement walls at least 60 inches below final grade unless noted otherwise on the demolition drawings or project Geotechnical Report.

D. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

3.6 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with according to backfill requirements in the project Geotechnical Report.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site, outside of permanent below grade debris area.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be Removed and Salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items

of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Review equipment or other applicable loads in existing floors

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, dust control, and noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and other tenants on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

E. Hazardous Materials: It is not expected that hazardous materials (including asbestos) will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer as necessary to perform an engineering survey of unforeseen conditions of the building/ building elements to determine whether removing elements might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

F. Survey of Existing Conditions: Record existing conditions by preconstruction photographs and submit to Owner/ Architect for record.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Arrange with Owner/ Building Manager to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Comply with requirements for dust control specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
5. Remove structural framing members and lower to ground by method suitable to avoid dust generation. Submit plan/ strategy to Architect if utilizing existing shafts or openings as chutes for transport of building debris.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections to avoid injury.

B. Masonry: Demolish in sections to avoid injury.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to remain permanently below ground, be salvaged, or otherwise as Owner's property, remove demolished materials from Project site and legally dispose of them.

1. Do not allow demolished materials to accumulate on-site, outside of permanent below grade debris area.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Existing Construction to Be Removed: Reference Architect’s/Structural Drawings for additional information.

B. Existing Items to Be Removed and Salvaged: Reference Architect’s drawings for additional information.

END OF SECTION

SECTION 03 25 00

WATERSTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install expanding bentonite-based waterstop as specified herein, illustrated on project drawings, or as required to complete the work to comply with waterproofing warranty requirements in Section 071000.

1.2 RELATED SECTIONS

A. Other specification Sections which directly relate to the work of this section include, but are not limited to, the following:

1. Division 7: Waterproofing

1.3 QUALITY ASSURANCE

A. Verification of Details: Contractor to notify the Architect immediately of any detail, note, or specification which does not comply with current manufacturer's installation requirements

B. Adhesion: Waterstop-RX is not a self-adhering product. Cetseal is required to secure Waterstop-RX. No other adhesive should be used. Mechanical fasteners can be used in conjunction with Cetseal adhesive, but should not be used solely to secure the waterstop.

C. Installation Instructions: Components and installation procedures shall be in accordance with current manufacturer's printed specifications and recommendations. Verify technical data submittals are the most current with manufacturer - (847)851-1800.

D. Expansion Joints: WATERSTOP-RX is not designed, nor intended for waterproofing or sealing expansion joints. Responsibility of waterproofing expansion joints is of others.

E. Concrete: Concrete shall be structural grade quality with a minimum 3000 psi tensile strength. For RX-101 and RX-101T a minimum thickness of 8" (200 mm) with two rows of reinforcing steel is required. For RX-102 a minimum thickness of 5" (125 mm) with a single row of reinforcing steel is required.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, with complete general and specific installation instructions, recommendations, and limitations.

B. NSF Standard 61 Certification: Submit Official NSF Listing for waterstop confirming that the products conforms to the requirements of NSF Standard 61 – Drinking Water System Components –Health Effects.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in factory sealed and labeled packaging. Sequence deliveries to avoid delays, while minimizing on-site storage. Handle and store following manufacturer's instructions, recommendations and material safety data sheets. Protect from construction operation related damage, as well as, damage from weather, excessive temperatures and prolonged sunlight. Remove damaged material from site and dispose of in accordance with applicable regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide Waterstop-RX bentonite waterstop and Cetseal adhesive as manufactured by Colloid Environmental Technologies Company (CETCO), 2870 Forbs Ave, Hoffman Estates, IL 60192, USA. Phone: (847) 851-1800; Fax: (847) 851-1899; Web-site: http://www.cetco.com., OR APPROVED EQUAL.

2.2 MATERIALS

A. Waterstop shall consist of sodium bentonite and butyl rubber compound formed into uniform coils.

B. NSF Certified: Bentonite waterstop shall be certified by NSF International to conform to the requirements of NSF Standard 61 – Drinking Water System Components – Health Effects.

C. BENTONITE WATERSTOPS (AS REQUIRED)

1. WATERSTOP-RX 101: 1" x 3/4" x 16'8"' rolls of a flexible strip of bentonite and butyl rubber compound for use in concrete construction joints - not designed for expansion joints.

2. WATESTOP-RX 101T: 1-1/4" x 1/2" x 20” trapezoidal rolls of flexible strip of bentonite and butyl rubber compound with a reinforcing poly scrim for use in concrete construction joints - not designed for expansion joints.

3. WATERSTOP-RX 102: 3/4" x 3/8" x 33'4” rolls of flexible strip of bentonite and butyl rubber compound for use in concrete construction joints - not designed for expansion joints.

D. ADHEISIVE

1. CETSEAL: A multipurpose UV stable single component polyether moisture cure sealant / adhesive.

PART 3 – EXECUTION

3.1 SUBSTRATE INSPECTION AND CONDITIONS

A. The installer shall examine conditions of substrates and other conditions under which this section work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements.

B. Installation shall not proceed when work areas are flooded or wet to the extent that would cause bentonite waterstop to hydrate prior to concrete encapsulation.

3.2 SURFACE PREPARATION

A. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the installation of the waterstop. Protect adjacent material surfaces from damage or contamination from during installation operations.

3.3 GENERAL INSTALLATION GUIDELINES

A. Install WATERSTOP-RX in all applicable vertical and horizontal cast-in-place concrete construction joints; and around applicable penetrations and structural members. Place WATERSTOP-RX to allow for minimum 3” (75 mm) concrete coverage on all sides (2” (50 mm) coverage for RX-102).

B. Apply continuous bead of CETSEAL (typical bead diameter 3/16” (5 mm)) to dry, smooth concrete surface maintaining a minimum 3” (75 mm) depth within the concrete joint.

C. Remove release paper from coil of WATERSTOP-RX. Firmly press the entire length of WATERSTOP-RX into the CETSEAL adhesive bead; resulting in the adhesive bead spreading to coat most of the bottom of the waterstop. Verify 3” (75 mm) minimum concrete coverage will be maintained over entire placement of waterstop. Place in maximum practical lengths to minimize coil end joints.

D. Tightly butt coil ends together to form continuous waterstop. Do not overlap coil ends. Where required, cut coils with sharp knife or utility blade to fit coil ends together without overlapping.

E. Following Steps 1-3, install waterstop around all applicable through wall pipes and mechanical penetrations; and around all applicable structural elements like metal H-Piles through the slab.

F. Protect installed waterstop from prehydration prior to concrete placement and product encapsulation. Replace any waterstop material that exhibit significant expansion prior to concrete encapsulation.

3.4 CLEAN UP

A. Clean areas where adjacent finished surfaces are soiled by work of this Section. Remove all tools, equipment and remaining product on-site. Dispose of section work debris and damaged product following all applicable regulations.

END OF SECTION

SECTION 06 42 19

PLASTIC-LAMINATE-FACED WOOD PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced wood panels.
2. Wood furring, blocking, shims, for installing plastic-laminate-faced wood panels that is not concealed within other construction.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that panels can be installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced wood panels.

1. Include plans, elevations, sections, and attachment details.
2. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program.

B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver panels until painting and similar operations that might damage panels have been completed in installation areas. Store panels in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install panels until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where panels is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support panels by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where panels is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood panels (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.

1. Provide inspections including installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 PLASTIC-LAMINATE-FACED WOOD PANELS

A. Grade: Custom.

B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3 and the following requirements:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.
b. Lamin-Art, Inc.
c. Wilsonart (basis of design).

2. Faces: Grade SGF.
3. Backs: Grade BKH.
4. Exposed Edges: Refer to Drawings.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:

1. As indicated by manufacturer's designations.

D. Panel Core: Fire-retardant particleboard or fire-retardant MDF.

1. Thickness: As indicated on Drawings.

E. Adhesives for Bonding Plastic Laminate: Resorcinol.

1. Adhesive for Bonding Edges: Hot-melt adhesive.

F. Fire-Retardant-Treated Panels: Panels shall consist of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. Assemble panels by gluing and concealed fastening.

2.3 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

B. Wood Moisture Content: 8 to 13 percent.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
3. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of panels.

2.5 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.

C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.6 FABRICATION

A. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition panels to humidity conditions in installation areas.

B. Before installing panels, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install panels to comply with quality standard grade of panels to be installed.

B. Install panels level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective panels, where possible, to eliminate defects. Where not possible to repair, replace panels. Adjust for uniform appearance.

B. Clean panels on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 07 17 00

BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this section includes, but is not limited to the furnishing and installing the following materials, or as required by water testing procedures.
1. Bentonite Voltex waterproofing membrane with all applicable accessory products.

1.2 SYSTEM DESCRIPTION

A. Provide waterproofing system to prevent the passage of liquid water and install without defects, damage or failure. Waterproofing shall be two high strength geotextiles interlocked encapsulating minimum 1.10-lbs per square foot (5.37 kg/sqm) granular sodium bentonite.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data, with complete general and specific installation instructions, recommendations, and limitations.

B. Product Samples: Submit representative samples of the following for approval:
1. Voltex waterproofing membrane

C. Material Certificates: Submit certificate(s) signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements. Submit certification that waterproofing system and components, drainage and protection materials are supplied by a single-source manufacturer.

D. Installer Certificate: At time of bid, submit written certification that installer has current Approved Applicator status with waterproofing material manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installing company should have at least three (3) years experience in work of the type required by this section, who can comply with manufacturer's warranty

requirements, and who is an Approved Applicator as determined by waterproofing/drainage system manufacturer.

B. Manufacturer Qualifications: Waterproofing membranes and all accessory products shall be provided by a single manufacturer with a minimum of 30 years experience in the direct production and sales of waterproofing systems. Manufacturer shall be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods.

C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field installation to establish procedures to maintain required working conditions and to coordinate this work with related and adjacent work. Verify that final waterproofing and waterstop details comply with waterproofing manufacturer's current installation requirements and recommendations. Pre-con meeting attendees should include representatives for the owner, architect, inspection firm, general contractor, waterproofing contractor, concrete contractor, excavating/backfill contractor, and mechanical and electrical contractors if work penetrates the waterproofing.

D. Materials: Obtain waterproofing membrane with accessory products from a single manufacturer to assure material compatibility.

F. Water Sample Test: Waterproofing contractor shall supply project site water sample to waterproofing membrane manufacturer for analysis. Manufacturer shall conduct test free of charge. Contractor is responsible for collection and shipment 64-fluid ounces (2-liters) of actual site water. Water should be shipped in uncontaminated, sealed plastic container to: CETCO, 2870 Forbs Ave, Hoffman Estates, IL 60192, Attn: BMG Field Services. Also provide project name, city and state along with return address to forward test results.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling: Deliver materials in factory sealed and labeled packaging. Sequence deliveries to avoid delays, while minimizing on-site storage. Handle and store following manufacturer's instructions, recommendations and material safety data sheets. Protect from construction operation related damage, as well as, damage from weather, excessive temperatures and prolonged sunlight. Remove damaged material from site and dispose of in accordance with applicable regulations.

B. Storage: Do not double-stack pallets during shipping or storage. Protect waterproofing materials from moisture, excessive temperatures and sources of ignition. Provide cover, top and all sides, for materials stored on-site, allowing for adequate ventilation.

1.6 PROJECT CONDITIONS

A. Substrate Condition: Proceed with work only when substrate construction and preparation work is complete and in condition to receive waterproofing system. All plumbing, electrical, mechanical and structural items to be under or passing through the waterproofing shall be positively secured in their proper positions prior to waterproofing system installation. Substrate preparation shall be per waterproofing manufacturer's guidelines.

B. Weather Conditions: Perform work only when existing and forecasted weather conditions are within the guidelines established by the manufacturer of the waterproofing materials. Do not apply waterproofing materials in areas of standing or active water; or over ice and snow. Though exposure to precipitation and ground water seepage typically will not adversely affect Voltex, the General Contractor shall maintain site conditions to remove standing water from precipitation or ground water seepage in a timely manner. Should Voltex be subjected to pre-hydration as a result of prolonged immersion, inspection of the material and written acceptance from CETCO is required prior to concrete or backfill placement.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide Voltex waterproofing membrane and applicable accessories as manufactured by Colloid Environmental Technologies Company (CETCO), 2870 Forbs Ave, Hoffman Estates, IL 60192, USA. Phone: Toll Free (800) 527-9948 or (847) 851-1800; Web-site: http://www.cetco.com/bmg, or approved equal.

2.2 MATERIALS

A. VOLTEX BENTONITE GEOTEXTILE WATERPROOFING MEMBRANE

1. VOLTEX MEMBRANE: 4' x 15' (1.2 x 4.5m) roll of interlocked geotextiles encapsulating a minimum 1.10-lbs per square foot (5.37 kg/sqm) of granular sodium bentonite. Composite shall consist of one woven and one nonwoven polypropylene geotextile, interlocked using a needle-punching process that produces several interlocks per square inch (6.5 sq cm) over the entire area of the product.

OR AS REQUIRED BY TEST:

2. VOLTEX CR MEMBRANE: 4' x 15' (1.2 x 4.5m) roll of interlocked geotextiles encapsulating a minimum 1.10-lbs per square foot (5.37 kg/sqm) of contaminant resistant granular sodium bentonite. Composite shall consist of one woven and one nonwoven polypropylene geotextile, interlocked using a needle-punching process that produces several interlocks per square inch (6.5 sq cm) over the entire area of the product.

Voltex / Voltex CR performance properties:

PROPERTY	TEST METHOD	TYPICAL VALUE
Hydrostatic Pressure Resistance	ASTM D 5385 mod.	231 ft. (70 m)
Permeability	ASTM D 5084	1×10^{-9} cm/sec.
Grab Tensile Strength	ASTM D 4632	95 lbs. (422 N)
Puncture Resistance	ASTM D 4833	100 lbs. (445 N)
Low Temperature Flexibility	ASTM D 1970	Unaffected at -25°F (-32°C)
Peel Adhesion to Concrete	ASTM D 903 mod.	15 lbs. /in. (2.6 kN/m)

B. ACCESSORY WATERPROOFING PRODUCTS: All accessory waterproofing materials shall be provided by the waterproofing manufacturer or shall have manufacturer's written approval for substitution.

1. Bentoseal®: Trowel grade detailing mastic
2. Hydrobar Tubes: 2" (50 mm) diameter x 2' (60 cm) long, water soluble tube container filled with active granular sodium bentonite
3. Waterstoppage®: 50 lbs. (22.7 kg) bag of active granular sodium bentonite.
4. SeamTape®: 2" (50 mm) wide butyl rubber sealant tape.
5. Termination Bar: Min. 1/8" thick by 1" (25 mm) wide stainless steel or aluminum termination bar with pre-punched holes punched 6" (150 mm) on center for fastening.
7. CETSEAL – single-component polyether general sealant and adhesive
8. GF-40SA – self-adhering flashing membrane used for grade and thru-wall detailing.

PART 3 – EXECUTION

3.1 SUBSTRATE INSPECTION AND CONDITIONS

A. The installer, with the Owner's Independent Inspector present, shall examine conditions of substrates and other conditions under which this section work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements. General substrate

conditions acceptable for the waterproofing installation are listed below. For conditions not covered in this Section, contact the waterproofing manufacturer for guidance.

B. PENETRATIONS: Mechanical, structural, or architectural materials that will pass through the plane of the waterproofing membrane shall be properly installed and secured in their final position prior to installation of the waterproofing system.

3.2 SURFACE PREPARATION

A. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the performance of the waterproofing and drainage system.

B. Protect adjacent work areas and finish surfaces from damage or contamination from waterproofing products during installation operations.

3.3 GENERAL INSTALLATION GUIDELINES

A. Property Line Walls, install Voltex membrane with the dark gray woven geotextile side in the direction to receive concrete pour; white geotextile side outward against retaining wall. Overlap Voltex membrane edges minimum 4” (100mm). Underslab, install Voltex with the dark gray woven geotextile side up; white geotextile side facing down. Overlap Voltex membrane edges minimum 4” (100 mm). Backfilled walls and roofs of earth covered structures, install Voltex with the white geotextile side outward, away from the concrete, facing the installer; dark gray geotextile against concrete. For backfilled walls overlap Voltex membrane edges a minimum 4” (100mm)..

B. Expansion Joints: Voltex waterproofing is not an expansion joint filler or sealant, but may be used as an expansion joint cover over a properly installed expansion joint material placed during substrate preparation. To use Voltex as an expansion joint cover, trowel 1/8" (3 mm) thick, 6" (150 mm) wide layer of Bentoseal centered over expansion joint. Install a 24" (60 cm) wide strip of Voltex centered over the expansion joint. Then install the main course of Voltex .

3.4 BACKFILLED CAST-IN-PLACE CONCRETE WALLS

A. Trowel 3/4" (18 mm) thick, continuous Bentoseal fillet at all inside wall corner transitions. Trowel Bentoseal form-tie pockets/patches and any slightly irregular concrete surface honeycomb areas.

B. Penetrations: For all pipe, rebar, structural and other penetrations install waterproofing system in accordance with manufacturer's detail for specific project condition(s).

C. Terminate Voltex membrane 12" (300 mm) below finished grade elevation secured with washer-head fasteners maximum 12" (300 mm) on center to exterior surface of concrete wall. Per manufacturer's detail for specific project condition(s), install GS-40SA grade flashing to primed concrete substrate with bottom edge overlapping top edge of Voltex membrane minimum 4" (100 mm). Overlap all roll ends a minimum 4" (100 mm) to form a continuous flashing. Height of flashing shall be as indicated. Install a rigid termination bar along the top edge of GF-40SA; fastened maximum 12" (300 mm) on center. Complete grade termination detail with tooled bead of CETSEAL along the top edge, at all penetrations through the flashing, and all exposed overlap seams.

G. Inspect finished Voltex installation and repair any damaged material prior to backfill placement. Assure that Voltex is not displaced during backfill placement or soil compaction.

3.5 CLEAN UP

A. In areas where adjacent finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their recommendations and instructions. Remove all tools, equipment and remaining product on-site. Dispose of section work debris and damaged product following all applicable regulations.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes furnishing and installing fire stop systems in the following construction, but does not include load-bearing repairs to concrete floor slab penetration holes.

1. Penetrations of fire rated floor and wall constructions both empty and those penetrated by cables, conduits, pipes, ducts and similar construction.
2. Openings between structurally separate sections of fire rated floors, walls, and expansion joints.
3. Gaps between top of fire rated walls and fire rated structural floor or roof construction.
4. Openings in fire rated walls and floors penetrated by structural members.
5. Safing slot gaps between edge of floor and curtain wall construction.
6. Other locations where specifically shown on the Drawings.

1.3 DESIGN/PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814, UL 1479, or UL 2079:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-Rated Systems: Provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas for the following conditions:

    a. Penetrations located outside wall cavities.
    b. Penetrations located outside fire-resistance-rated shaft enclosures.
    c. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
2. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

3. Manufacturer's Project Site Representative: Arrange to have manufacturer's direct representative (not distributor or agent) on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures per manufacturer's written recommendations and instructions applicable to penetration designs used.

B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in its "Fire Resistance Directory."

C. Mock-Up: Prepare Jobsite mock-ups of each different type of firestopping and smoke seal design required at locations selected by Architect. Approved mock-ups may be left in place as part of the Work and constitute the standard for remaining work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide complete fire stop systems that use only products listed in one of the rated designs scheduled in Part 3 of this Section, that are produced by one of the following manufacturers, and that do not require material changes in details and construction of related work:

1. Hilti, Inc. (Hilti)
2. 3M Fire Protection Products (3M)
3. Specified Technologies, Inc. (STI).
4. Rectorseal, Inc.
5. Tremco, Inc.

B. Firestopping Material: Provide the following asbestos free materials arranged in designs which produce Flame (F) and Temperature (T) ratings of not less than one hour but not less than the fire resistance rating of the assembly being penetrated, as tested per ASTM E 814.

1. Intumescent Putty: One part hand moldable 100% solids intumescent putty, UL listed for both Flame (F) and Temperature (T) ratings, and designed to restrict transmission of temperature as well as passage of flame, smoke and water; Hilti CP 618 Firestop Putty Stick or Hilti CP 617 or CP 617L Firestop Putty Pads, 3M Fire Barrier Moldable Putty, STI Spec Seal Firestop Putty, Rectorseal Metacaulk Fire Rated Puty, or Tremco Tremstop putty, as appropriate for designs required.
2. Intumescent Firestop Sealant: One part sealant, providing an airtight, waterproof seal that bonds to most building materials, available in a gun grade for wall and overhead applications and self leveling for floor applications, UL listed for both Flame (F) and Temperature (T) ratings, and designed to restrict transmission of temperature as well as passage of flame, smoke and water; Hilti FS One, Hilti CP 606, Hilti CP 601S, 3M Fire Barrier CP 25 WS+, Rectorseal Metacaulk 1000 Firestopping Sealant, or STI Spec Seal SSS100 sealant, or Tremco Tremstop IA sealant, as appropriate for designs required.
3. Firestop Device: Prefabricated device designed for use around plastic pipe penetrations of fire-rated walls and floors, made from a steel collar with intumescent material, UL listed for both Flame (F) and Temperature (T) ratings; Hilti CP 644 or CP 643 Firestop Collars, 3M Fire Barrier Plastic Pipe Device, or STI Firestop Collars, or STI SpecSeal Pillows, Rectorseal Metacaulk Firestopping Pillows or Pipe Collar, or Tremco Tremstop D collar, as appropriate for designs required.
4. Cast-in Place Firestop Devices: for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable; Hilti CP 680, or CP 681, or CP 682, Hilti Cast-In Firestop Devices, Tremco Firecan.
5. Intumescent Sheet/Trowelable Compound: Composite sheet of intumescent material or trowelable intumescent compound used to seal large openings and seal penetrations against flame spread, smoke and toxic fumes, UL listed for both Flame (F) and Temperature (T) ratings; Hilti FS 637 Firestop Mortar, Hilti 675T Firestop Board, 3M Fire Barrier CS 195 Composite Sheet, or Rectorseal Metacaulk Fire rated Putty, or STI SpecSeal SSM Mortar, or Tremco Tremstop M mortar, as appropriate for designs required.
6. Firestop Blocks, Foam or Pillows: Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable; Hilti CP 657 Fire Block, Hilti CP658T Firestop Plug, Hilti CP 620 Firefoam.
7. Silicone Sealant: One part, gun-grade, ready to use, moisture curing, silicone sealant; Hilti CP 601S, 3M Fire Barrier 2000 Sealant, or STI SpecSeal Pen 300 Sealant, or Tremco Fyre-Sil gunnable or self-leveling sealant, as appropriate for designs required.

8. Elastomeric Spray: Sprayable elastomeric firestop sealant for construction joints; Hilti CP 672 Speed Spray, STI SpecSeal AS105, or 3M Fire Dam 150 Spray, or Rectorseal Metacaulk 1200 Spray Applied Mastic, or Tremco Tremstop Acrylic gunnable sealant or spray, as appropriate for designs required.
9. Damming Insulation: ASTM C 612, Class 1 and 2, spun mineral wool non-combustible felts with UL Fire Hazard Classification (ASTM E 84) of 15 Flame Spread, 0 Fuel Contributed, and 0 Smoke Developed; United States Gypsum Company "Thermafiber" Fire Safing Insulation, Hilti CP 777 Speed Plugs, Hilti CP 767 Speed Strips, or Tremco CeraBlanket mineral wool, or equivalent.

C. Miscellaneous Materials: Provide anchoring devices, restricting collars, backup materials, clips, sleeves, supports and other miscellaneous materials used in actual fire tests, compatible with firestopping products and substrates, approved for use as indicated by firestopping products manufacturer, and which have been approved by UL or other acceptable testing and inspecting agency for use in fire-resistance rated designs indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Require installer to examine substrates to determine if they are in satisfactory condition and do not have defects that would interfere with the satisfactory installation of firestopping materials.

3.2 PREPARATION

A. Clean surfaces and substrates of dirt, oil, loose materials, and other foreign materials that may affect proper bond or installation of firestops in accordance with manufacturer's written instructions.

1. Provide proper primers as required for conditions and which comply with manufacturer's recommendations for substrates and conditions.
2. Do not apply firestops to surfaces previously painted or treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required to comply with manufacturer's instructions.
3. Mask to protect adjoining surfaces. Remove excess material and stains on surface of materials not indicated to receive firestopping materials.

3.3 INSTALLATION

A. Install firestopping materials in accordance with manufacturers printed instructions to provide a Flame (F) and Temperature (T) rating of at least one hour but not less than the rating of the assembly being penetrated.

B. Ensure that anchoring devices, backup materials, clips, sleeves, supports and other materials used in the actual fire test are installed.

C. Install firestops with sufficient pressure to properly fill and seal openings and to ensure an effective smoke seal.

D. Tool or trowel exposed surfaces of firestops to eliminate air pockets and to ensure contact and adhesion of firestopping material to substrates. Remove excess firestop material promptly as work progresses and upon completion.

3.4 FIELD QUALITY CONTROL:

A. Promptly notify Architect if specified firestop systems cannot comply with requirements specified.

B. Installer shall examine firestops for proper installation and compliance with specified requirements.

C. Maintain accessibility of each installation area until completion of applicable inspections by governing authorities.

D. Remove and reinstall unacceptable firestops and arrange for reinspection to verify compliance with requirements.

3.5 FIRESTOPPING SYSTEM AND APPLICATION SCHEDULE

A. Provide one of the following UL listed firestopping designs and associated materials at each of the penetration types indicated or required for the Project.

3M	Hilti	Rectorseal	STI	Tremco
CAJ1001, CAJ1006, CAJ1009, CAJ1014, CAJ1015, CAJ1015, CAJ1017	CAJ 1149, CAJ 1150, CAJ 1154, CAJ 1155, CAJ 1156, CAJ 1158, CAJ 1172, CAJ 1173, CAJ 1184, CAJ1226, CAJ	CAJ1115, CAJ1186, CAJ1272, CAJ1059, , CAJ1036, CAJ1035	CAJ1030, CAJ1213, CAJ1045, CAJ1214, CAJ1048, CAJ1215, CAJ1079	CAJ1233, CAJ1064, CAJ1288, CAJ1205, CAJ1187, CAJ1145, CAJ1047
WL1001, WL1010, WL1002, WL1017, WL1003, WL1036, WL1009	WL 1052, WL 1054, WL 1056, WL 1058, WL 5029, WL 1085, WL 1164, WL 1165, WL 1175, WL 1205, WL 1206, WL 1243, WL 1252, WL 1289, WL 1290, WL 1297	WL1026, WL1034, WL1253, WL1140, WL1024, WL5056, WL1144, WL5063, WL5061,	WL1028, WL1079, WL1029, WL1088, WL1033, WL1090, WL1049, WL1093, WL1062,	CAJ1233, CAJ1064, CAJ1288, CAJ1205, CAJ1187, CAJ1145, CAJ1047, CAJ1179, CAJ1113
CAJ5001, CAJ5030, CAJ5002, CAJ5041, CAJ5003, CAJ5060, CAJ5005, CAJ5004, CAJ5009, CAJ5017,	CAJ 5044, CAJ 5045, CAJ 5046, CAJ 5048, CAJ 5090, CAJ 5091, CAJ 5184, CAJ 5185, CAJ 5198, CAJ 5061, CAJ 5069, CAJ 5096, CAJ 5098, CAJ 5230, FA 5017, FA	CAJ5077, CAJ5078, CAJ5110, CAJ1247, CAJ8067, CAJ5134, CAJ5136	CAJ5010, CAJ5005, CAJ5021, CAJ5006, CAJ5029, CAJ5011, CAJ5042, CAJ5051, CAJ5058, CAJ5087	CAJ5067,CAJ5121,CAJ5081, CAJ5005
WL5001, WL5032, WL5002, WL5038, WL5009, WL5039, WL5010	WL 5016, WL 5025, WL 5017, WL 5028, WL 5019, WL 5029, WL 5021, WL 5022, WL 5046, WL 5047, WL 5096, WL 5126, WL 5143, WL 5144	WL5077, WL5075, WL5092, WL8016	WL5014, WL5051, WL5025, WL5054, WL5026, WL5027, WL5028	WL5082, WL5081, WL5083

Penetration Type	Hilti	Rectorseal	STI	Tremco
Metal Pipe Penetration Through Concrete or Masonry	CAJ 2062, CAJ 2110, CAJ 2066, CAJ 2091, CAJ 2141, CAJ 2109, CAJ 2118, CAJ 2095, FA 2092, FA 2053, FA 2093, FA 2054, FA 2094, FA 2075, FA	CAJ2134, CAJ2153, FA2051, CAJ2269, CAJ2265, FA2049, CAJ2113	CAJ2038, CAJ2095, CAJ2039, CAJ2098, CAJ2045, CAJ2105, CAJ2056	CAJ2229, CAJ2233, CAJ2184, CAJ2075, CAJ2074, CAJ2116, CAJ2076
Metal Pipe or Conduit Through Gypsum	WL 2051, WL 2098, WL 2052, WL 2078, WL 2053, WL 2075, WL 2217, WL 2128,	WL2262, WL2104, WL2121, WL2108,	WL2048, WL2076, WL2059, WL2078,	WL2176, WL2076, WL2177, WL2078,
Insulated Metal Pipe Through Concrete or Masonry	CAJ 3069, CAJ 3070, CAJ 3079, CAJ 2095, CAJ 3139, CAJ 3152, CAJ 3180, CAJ 3181, CAJ 3193, CAJ 3198	CAJ3086, CAJ3101, CAJ3087, CAJ3100, CAJ3086, CAJ4047, CAJ3127,	CAJ3042, CAJ3043, CAJ3084, CAJ3095, CAJ3096	CAJ3141, CAJ3144, CAJ3068
Insulated Metal Pipe Through Gypsum	WL 3045, WL 3046 WL 3047, WL 3048 WL 3065, WL 3161, WL 3071, WL 3079,	WL8001, WL3014, WL3108, WL3013,	WL3024, WL3065, WL3025, WL3076,	WL3131, WL3043
	CAJ 4017, CAJ 4035, CAJ 4034, CAJ 4054, CBJ 4025, CBJ 4026, WJ 4016, WJ 4030,	CAJ6031, CAJ6025, CAJ4049, CAJ8043	CAJ6006, CAJ8016, CAJ8033, CAJ8035,	WJ4005, WJ4012
	WL 4011, WL 4034, WL 4019, WL 4006, WL 5016, WL 4035	WL6015, WL6008, WL7012	WL4005, WL4008	WL4012

Penetration Type	3M
Plastic Pipe Through Concrete or Masonry	CAJ2001, CAJ2028, CAJ2002, CAJ2040, CAJ2003, CAJ2090, CAJ2005
Plastic Pipe Through Gypsum	WL2002, WL2005, WL2003, WL2033,
Jacket Cable Through Concrete or Masonry	CAJ3001, CAJ3031, CAJ3005, CAJ3041, CAJ3009, CAJ3044, CAJ3010,
Jacket Cable Through Gypsum	WL3001, WL3030, WL3008, WL3031,
Cable Tray or Electric Bussway Through	CAJ4003, CBJ4005, CAJ4006, CBJ4021,
Cable Tray or Electric Bussway	WL4004

Rectorseal	STI	Tremco
WJ2073, WJ2025, WJ2035, CAJ2151, CAJ2112, CAJ2265, CAJ2269, CAJ2157	CAJ1208, CAJ1209, CAJ8016, CAJ8033, CAJ8035, CAJ8036, CAJ8052, CAJ5042,	CAJ3141, CAJ3144, CAJ8034, CAJ8057
WL8016, WL1183, WL1122, WL2132, WL2117WL2201 WL2238	WL1093, WL8003, WL8011	WL3131, WL3043
	WWS0017, HWD1001, WWS1009, WWD0001, WWS1010, WWD1001,	WWJ0024, WWD0009, WWJ0025, WWD0010, CAJ0011, CAJ0026
HWD0058, HWD0221, HWD0127, HWD0129, HWD0125, WWD0023, HWD0014, HWD0018, HWS0023,	WWS0017, FWD1001, WWS1009, HWD1001, WWS1010, WWD0001, WWS0023, WWD1001, WWS0029,	HWD0016, HWD0017
Contact one of the specified manufacturer's technical representatives and request an engineered drawing detail to suit field conditions. Provide manufacturer's		

Penetration Type	3M	Hilti
Mixed or Multiple Penetrating Items Through Concrete or Masonry	CAJ1066, CBJ1020, CAJ1092, CBJ1021, CAJ1148, CBJ1031, CAJ2020, CBJ8004, CA	CAJ1140, CAJ1172, CAJ1174, CAJ5044, WJ8004, CAJ8056, CAJ8041, CAJ6006
Mixed or Multiple Penetrating Items Through Gypsum	WL1016, WL2032, WL1037, WL3051, WL2031, WL3062	WL1057, WL1095, WL8013, WL8004
Expansion Joint, Curtain Wall, Safing, Slots,, and Constructi	CAJ0004, J900B, CBJ0013, J900C, CBJ0020, U900J, WJ0003, U900L	FF-S-1008, WL1095, WWS-1011, FW-S-1002, FFS-1017
Wall/Ceiling Interface Between Top of Wall and Roof Deck	N/A	HW-D-0003, HW-D-0010, HW-D-0004, HW-D-0042, HW-D-0005, HW-D-0008
Applications Not Listed		

END OF SECTION

SECTION 07 90 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Summary: Section includes furnishing and installing joint sealants and back-up materials at locations indicated and required to comply with performance requirements.

1.2 PERFORMANCE REQUIREMENTS

A. It is required that sealant work provide durable weathertight joint seals that are well cured, of uniform depth, tooled to provide good adhesion to sealant bond surfaces, and not to deteriorate in excess of limits published by sealant manufacturer.

1.3 SUBMITTALS

A. Submit manufacturer’s product data and details showing layout of recommended minimum and maximum joint width to depth relationships, and recommended primers for substrates and conditions indicated. Include material specifications showing compliance with requirements.

B. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility and adhesion of exterior sealants with each material that will come in contact with sealants and each condition required by systems.

1. Test a minimum of 12 samples of each metal, glazing, and other material. Determine adhesion test data of sealant bond to actual production samples of finished metal and glass that will be incorporated into the work. Perform adhesion tests in accordance with ASTM C 794.
2. Prepare samples using techniques and primers required for installed systems.
3. Perform tests under environmental conditions that duplicate those under which systems will be installed.
4. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.
5. Compatibility statement that the materials in contact with the sealant such as gaskets, spacers, setting blocks, are compatible with the sealant after 21-days exposure to 2000 to 4000 microwatts of ultraviolet radiation.

6. Stress statements that the sealant dimensions (per detail) do not exceed 20-psi when exposed to the specified wind load (6:1 Safety Factor).
7. Certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and finds same suitable for the purpose intended and compatible with the surfaces with which they are in contact.

1.4 QUALITY ASSURANCE

A. Perform preconstruction joint sealer/substrate tests to confirm adhesion and compatibility and field tests to confirm technique required for appearance and adhesion.

1.5 DELIVERY, STORAGE AND PROTECTION

A. Deliver materials and store in manufacturer's original unopened containers. Store materials between 40-degrees F (4-degrees C) and 90-degrees F (32-degrees C).

1.6 PROJECT CONDITIONS

A. Do not apply joint sealants, primers, and related materials to surfaces without first verifying compatibility required by the Quality Assurance paragraph. Install sealants when air temperature and substrate temperature are over 40-degrees F (4-degrees C) and rising, but less than 100-degrees F (37-degrees C).

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

A. Type "A" - Acrylic-Emulsion Sealant: Manufacturer's standard, one- part, non-sag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and protected exterior exposures involving joint movement of not more than ± 7.5%.

1. Products: Subject to compliance with requirements, provide Pecora Corp. "AC-20+Silicone" or Sonneborn Building Products Division/Rexnord Chem. Products, Inc. "Sonolac" or Tremco, Inc. "Tremco Acrylic Latex Caulk 834."
2. Locations: All exposed interior locations.
3. Colors: As selected by Architect from manufacturer's standard colors.

B. Type "B" - Butyl Sealant: Manufacturer's standard one-part, non-sag, solvent release curing, polymerized butyl sealant complying with FS TT- S-001657 for Type I and formulated with minimum of 75% solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

1. Products: Subject to compliance with requirements, provide Bostik Construction Products Division "Chem-Calk 300" or Pecora Corp. "BC-158" or Polymeric Systems, Inc. "PSI-301" or H. B. Fuller Co. "PTI 757" or Tremco, Inc. "Tremco Butyl Sealant."
2. Locations: Concealed interior locations.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

1. Products: Subject to compliance with requirements, provide Pecora Corp. "BA-98" or Tremco Inc. "Tremco Acoustical Sealant" or US Gypsum "Acoustical Sealant" or Sika "Sikaflex 11 FC."
2. Locations: Concealed gypsum drywall partitions perimeter and penetrations.

D. One-Part Non-Acid Curing Silicone Sealant: ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, M, G, A, and, as applicable to joint substrates indicated, O; medium modulus with a tensile strength between 45 psi and 75 psi at 100% elongation when tested after 14 days at 77-degrees F (25-degrees C.) and 50% relative humidity per ASTM D 412.

1. Products: Subject to compliance with requirements, provide either GE Construction Sealants; “Silpruf 2000" or Dow Corning Corp.. "795 Building Construction Sealant."
2. Locations: All exterior locations not otherwise noted or specified, including interior sealant joints on interior side of components subject to thermal movement from exterior heat sources.
3. Colors: Shall match existing.

2.2 ACCESSORY MATERIALS

A. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

B. Joint Sealant Backing:

1. ASTM C1330; closed-cell polyethylene foam rod, non-gassing; Nomaco "Noma Spec," or approved equivalent.
2. Expanding foam sealant; Polytite B by Polytite Manufacturing Corp. or Polyseal by Sandell Mfg. Co., or "Colorseal" by Emseal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examination:

1. Examine substrates and verify that joint dimensions are correct and that substrate is in proper condition to receive sealants.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Cleaning Joints:

1. Clean out joints just before installing sealants; follow joint sealer manufacturer's recommendations.
2. Remove dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil, grease, water repellents, water, surface dirt and frost, and other similar materials which would prevent or reduce sealant bond.
3. Clean metal, glass, and other non-porous surfaces by means that are not harmful to substrates or leave residues capable of interfering with sealant adhesion.

C. Joint Sealant Backing: Install joint backing without twisting, compress more than 50%, or stretch during installation. Install sealant backup materials to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. For joints 1/4-inch to 1/2-inch wide, install backer rod to provide sealant joint depth equal to joint width.
2. For joints wider than 1/2-inch, install backer rod at depth to provide 1/2-inch sealant joint depth.
3. Do not leave gaps between ends of joint-fillers. Do not stretch, twist, puncture or tear joint-fillers. Remove absorbent joint-fillers that have become wet prior to sealant application and replace with dry material.
4. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joints.
5. Provide joint sealant over all sight exposed backer rod, expansion joint filler, and expanding foam sealant.

D. Bond Surface Priming:

1. Prime cleaned joint substrates where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience.
2. Follow joint sealer manufacturer's recommendations.
3. Confine primers to sealant bond area; do not allow spillage or migration onto adjoining surfaces.
4. Prime bond surfaces prior to installation of sealant joint backing.

E. Mixing:

1. Mix multi-part sealants in accordance with sealant manufacturer’s printed instruction, using only whole units.
2. Do not use partial units.

3.2 INSTALLATION

A. Manufacturer’s Instructions: Follow sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Masking: Mask surfaces that might be permanently stained or damaged by sealant contact or by cleaning methods required to remove sealant smears. Promptly remove tape after tooling without disturbing joint seal.

C. Installation Technique: Install sealants using techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

D. Tooling: Tool non-sag sealants slightly concave prior to time skinning or curing begins to form smooth, uniform beads, to eliminate air bubbles and air pockets, and to assure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

E. Protection: Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. Procedure: Make a cut in the sealant across the joint for the entire depth of the sealant. Make two vertical cuts several inches long, paralleling the sides of the joint as closely as possible and extending down from the cross cut. Grasp the free length of sealant and pull at a 90-degree angle, tearing sealant from joint for several inches.

B. Interpretation of Results: Field quality control test results shall be interpreted as follows:

1. Sealant Tears Cohesively: Pass
2. Sealant Fails in Adhesion at Joint Face: Fail; remove sealant, prepare joint bond surfaces anew, and reinstall sealant to comply with requirements.

END OF SECTION

SECTION 08 44 13

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY:

A. Glazed wall system work includes furnishing and installing the complete glazed aluminum curtainwall system in areas indicated.

B. Also included in the work of this Section is all work associated with:

1. Glass and glazing in conjunction glazed aluminum curtain walls.
2. Sealants, caulking, joint fillers, gaskets, blocking, and related materials.
3. Mock-up and testing.
4. Field testing.
5. Cleaning of the work during construction and final cleaning.

C. The term "Contractor", as used in this Section, means the glazed wall system contractor who shall be a subcontractor of the General Contractor. The General Contractor shall be responsible to the Owner for all work of the glazed wall system contractor. The glazed wall system contractor shall have undivided responsibility for performance and other requirements and shall have not less than 5 years successful experience in the fabrication and erection of wall framing systems of scope and type similar to the required work.

1.2 RELATED WORK OF OTHER SECTIONS:

A. Coordinate work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

1.3 SYSTEM DESCRIPTION:

A. The glazed aluminum curtainwall system shall match existing and consist of individual members erected separately. Major components consist of aluminum vertical exterior mullions, horizontal rails, and matching glazed spandrel panels and vision glass.

B. Maintain design concept to match existing (member sizes, basic profiles, and component alignment). Modify only as necessary to meet performance requirements.

1. Acceptable Manufacturers Include:

a. EFCO Corporation.
b. Olde Castle, Inc.

c Kawneer, North American, an Arconic Co.

1.4 QUALITY ASSURANCE:

A. Contractor's responsibilities include but are not limited to the following items:

1. Examine and study the Drawings and Specifications to insure the work as described is complete and submit written notification to the General Contractor of all discrepancies. Direct requests for clarification of conditions to the General Contractor.
2. Examine and study the Drawings and Specifications with regard to the surfaces and structural framing to which all applicable work in this Section is attached and/or anchored. Submit written notification to the General Contractor of all deficiencies and detrimental factors which would affect proper and timely installation of the work of this Section. Furnish and install supplementary parts necessary to complete items described on the Drawings and in the Specifications, even though not definitely shown or specified. Design and size framing sections and components to meet the performance and design requirements. Furnish and install clips, bracing, and steel framework for proper anchorage of the glazed wall system elements to the structure.
3. Coordinate and verify, by measurement at the Project Site, all dimensions affecting work of this Section. Bring field dimensions which are at variance with those on the accepted shop drawings to the attention of the General Contractor. Obtain decisions regarding corrective measures from the General Contractor before the start of installation of affected items. Assure compatibility of adjacent items in relationship to work of this Section.
4. Cooperate with the General Contractor in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay Job progress.

B. Standards:

1. Comply with applicable standards and specifications published by NAAMM, AAMA, and AA, including definitions of terms and designations not otherwise defined herein.
2. Comply with applicable standards and recommendations by NAAMM, in "Metal Curtain Wall Specifications Manual", "Entrance Manual" and other published specifications and standards, except to the extent more stringent requirements are indicated.
3. Comply with the "GANA Glazing Manual" issued by the Glass Association of North America (GANA), latest edition.
4. Aluminum Association (AA) "Standards for Anodically Coated Aluminum Alloys for Architectural Applications".
5. Aluminum Association "Standards for Aluminum Mill Products", latest edition.
6. National Association of Architectural Metal Manufacturers (NAAMM/NOMMA) "Metal Finishes Manual".

1.5 SYSTEM PERFORMANCE REQUIREMENTS:

A. Provide the manufacturer's stock curtain wall system, adapted to the application indicated, complying with performance requirements as demonstrated by testing the manufacturers corresponding stock systems according to the following:

1. Wind pressures normal to the glass at the glazed wall system elements in accordance with the uniformly distributed wind pressure and suction values indicated on the Drawings.
2. Movements of supporting structure indicated on Drawings including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Allowable stresses for all metal structural elements of the work of this Section shall be established by the glazed wall system contractor and shall conform to the minimum standards as published in the Aluminum Association's "Aluminum Construction Manual - Specifications for Aluminum Structures".
4. The deflection of any metal framing member in a direction normal to the plane of the wall shall not exceed 1/200 of its clear span or 3/4", whichever is less. Reduce allowable wall deflections where conditions would result in deleterious effects on the wall components (deformation of framing, glass and gasket dislocations, seal failures, and similar system failures).
5. For the most severe loading, as specified above, the maximum deflection of any section in the plane of the glass shall not exceed 1/8".
6. The deflection of any horizontal member supporting glass, when carrying its full design dead load, shall not: exceed 1/360 of the clear span of the member or 1/8" in the plane of the glass, whichever is less; reduce the glass bite to less than 75% of the design dimension; and reduce the edge clearance of glass to less than 1/8" to all adjacent fixed parts and members.
7. Main framing members shall not sustain permanent deformation in excess of 0.1% (1/1000) of their clear span after completing the specified structural performance tests.

B. Water Penetration:

1. Water penetration, in this Specification, is defined as the appearance of water, other than condensation, on the interior (room) side of any part of the assembly offering protection from the elements to interior building spaces which is not drained to the exterior without damaging or deteriorating finish and other materials.
2. Make provision, as indicated, to drain to the exterior of the wall all water entering at joints, glazing reveals, and all condensation occurring within unit construction.
3. No water penetration shall occur when the assembly is tested in accordance with ASTM E 331, "Test For Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Pressure Difference" and AAMA 501.1. "Standard Test Method For Metal Curtain Walls For Water Penetration Using Dynamic Pressure" (except no water penetration allowed) with a test pressure differential of 8 psf.

C. Limit air infiltration through glazed wall system to 0.06 cfm/sq. ft. of fixed unit area at a test

pressure differential of 6.24 psf when tested in accordance with ASTM E 283, "Rate of Air Leakage Through Exterior Windows, Curtain Walls, And Doors".

D. Design and construct glazed wall system to provide for noiseless expansion and/or contraction of component materials as will be caused by a wall material temperature from 0 deg F to 180 deg F without causing harmful buckling, failure of joint seals, undue stress on fasteners and glass, or other detrimental effects.

E. Except where specifically shown otherwise on Structural Drawings, provide all support steel and connection elements and assemblies for support of glazed wall system work.

1. Design supporting elements for glazed wall system anchorage assemblies and lateral support bracing to the structure and all structural connections of the glazed wall systems in conformance with the applicable codes and the following requirements:

    a. The specific layouts are indicated on the Drawings. Variations from such layouts may be permitted by the Architect, but only if a proposed revision does not, in the Architect's opinion, cause excessive stress in the structure, cause excessive deflection, inhibit thermal movement, or conflict with other requirements such as clearance for mechanical equipment, etc.
    b. Member shapes shown on the Drawings are not necessarily the exact shapes required or best suited for the particular condition. Design final shapes and locations by a registered professional engineer employed by the Contractor and show on shop drawings.
    c. Properly brace all points of support for the glazed wall system work in the 3 orthogonal directions (vertical, transverse, and longitudinal) to resist all loads from any direction (both pressure and suction).
    d. Design anchorage and supports to accommodate variation as proposed by General Contractor and accepted by Architect (up/down, in/out) from theoretical location of supporting structure and adjacent construction.
    e. Design anchorage and supports so that installed assembly will not permit more than 1/16" movement at the connection when the most severe design loading is applied.
    f. The curtainwall is to be typically designed to accommodate at least 3/8" differential live load and long term structure settling movements in addition to the required thermal movement.

F. Perform tests for proper adhesion and cohesion of sealants, using methods recommended by sealant manufacturer and accepted by Architect, prior to start-up and during installation of sealant work to demonstrate proper techniques for cleaning joints, application of sealant primers, and sealants.

1. Perform not less than 50 pull tests with test areas including glazed wall system, sloped glazing system, and veneer system. Tests shall be performed with sealant

manufacturer's technical representative present. Submit written reports of test data and joint substrates tested.

1.6 SUBMITTALS:

A. Submit a listing of all manufactured and fabricated products and components which will be used in the glazed wall system work. Submit manufacturer's specifications and installation instructions for required products.

B. Submit shop drawings, including metal and glass thickness, details of all field connections and anchorage, fastening and sealing methods, metal finishes, location of all joints, direction of expansion of wall and related components, exposed fasteners, work to be performed by other trades which adjoins and/or is secured to glazed wall system components, and all other pertinent information.

1. Show full and complete details of the entire system, related construction, general layout and elevations, glazing system, and setting blocks, connections, shims, flashing transitions and joinery at components, glass types and sealant types.
2. Show sequence of erection. Accommodate deviation and qualification to the erection sequence by General Contractor without altering the design profiles.
3. Submit engineering calculations with first submittal of shop drawings.
4. Do not change shop drawings and data bearing Architect's final review stamp, or deviate from construction operations, unless changes and deviations are coordinated with glass manufacturer and submitted to Architect for review.
5. Begin fabrication only after receiving shop drawings bearing Architect's final review stamp.
6. Submit shop drawings bearing Architect’s final review stamp to governing authorities having jurisdiction.

C. Submit engineering calculations, prepared and certified by a registered civil or structural engineer licensed in the State where the Project is located, as accepted by the Architect. Include justification of all glazed wall system elements, fasteners, and anchorage components for compliance with criteria established in the "Quality Assurance" Article of this Section. Include magnitude of allowable structural deflections at all principle framing elements and the structural analysis of all connections. Acceptance of calculations and shop drawings by the Architect will not relieve the Contractor of any responsibilities for providing a system within the required performance requirements. If the structural calculations indicate any deficiencies, the Contractor shall, at his expense, provide all items necessary to comply with the performance requirements.

D. Submit the following sealant manufacturer's data and information for review:

1. Adhesion test data of sealant bond to actual production samples of finished metal and glass that will be incorporated into the work. Perform adhesion tests in accordance

with ASTM C 794.

2. Compatibility statement that the materials in contact with the sealant such as gaskets, spacers, setting blocks, are compatible with the sealant after 21 days exposure to 2000 to 4000 microwatts of ultraviolet radiation.
3. Stress statement that the sealant dimensions (per detail) do not exceed 20 psi when exposed to the specified windload (6:1 Safety Factor).
4. Certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and finds same suitable for the purpose intended and compatible with the surfaces with which they are in contact.

E. Submit three 12" long samples of production run extrusions showing proposed maximum color and texture range intended for the Project. Such range is subject to acceptance by Architect. Identify all samples as to gage, alloy, color, finish treatment, and portion of work to which samples apply.

F. Provide 1 cut-away sample of each typical glazed wall system vertical to horizontal member joinery element. Samples to be approximately 3' square, finished as specified, and showing all elements in their final location.

G. Submit 3 copies each of detailed procedures for the periodic inspection, maintenance, and cleaning of all applicable glazed wall system elements, including glass and metal finishes.

H. Provide test reports from a qualified independent testing laboratory, along with "as-built" mock-up drawings that show compliance of the manufacturer's stock glazed aluminum curtain wall system with performance requirements indicated based on comprehensive testing of the system by the laboratory within the last 3 years current production of the system by the manufacturer.

I. Prior to final acceptance of the work under this Section, transmit 2 "as-built" of all shop drawings and engineering calculations to General Contractor for the permanent Project file. Show all components as actually fabricated and erected.

1.7 MOCK-UP AND TESTING:

A. After the award of the glazed wall system work and on the basis of the Architect's preliminary acceptance of materials for the proposed design of glazed wall system assembly, the Contractor shall construct a full scale mock-up for the purposes of testing for structural performance, water penetration, and air infiltration as hereinafter specified. Visual acceptance will be based on finish match and uniformity, flatness, construction, joints, and seals.

1. Engage an independent testing laboratory, acceptable to Architect, to perform required testing.
2. Include costs of all testing including furnishing, handling, and installing all components

as part of the work of this Section. Perform testing at an approved facility accepted by the Architect and witnessed by an independent observer of the Architect's selection.

3. Utilize suitable instruments and gages calibrated and positioned to indicate actual face pressure on glass, and to record deflections for glass, mullions, and other aluminum components during testing. Record water pressure with appropriate gages.
4. Notify Architect and Owner, in writing, a minimum of 4 weeks prior to start of construction of test assembly and a minimum of 2 weeks prior to conducting any tests. Include the name of a complete and detailed description of the test facilities to be used with notification, including list of personnel who will perform the test and a step by step outline of the test procedure with schematic diagrams describing the location of deflection gages for the Structural Performance Tests; do not proceed until accepted. Do not perform pretesting or preliminary loading on the mock-up without the approval of and the presence of the Owner's representative.

    a. Contractor shall include cost for travel and lodging expenses for two people from the Architect's office to witness the testing.

5. Submit 4 copies of test reports to the Architect for his final review and acceptance. Reports shall comply with requirements of the referenced test standards.
6. Take a minimum of two photographs of each side of the test assembly, sufficient in number and aspect to accurately portray the mock-up test unit. Submit three 8" x 10" glossy prints, identified on the reverse side with the name of the Project, name of test assembly, date of test, description of the view, and negative number.
7. Include detail as-built drawings of the mock-up unit with actual dimensions and thicknesses of all component parts including actual measured sizes of tested glass panes to 1/32" of width and height and 0.001" for thickness, with the test report. Make reference copies of the above drawings available during test.
8. Proceed with the production of materials after receipt of the Architect's written acceptance of the test report.

B. The extent of the glazed wall system mock-up test assembly is shown on the Drawings. Submit definitive drawings describing the proposed scope or extent of the mock-up unit, and proceed with fabrication of mock-up only after the Architect has reviewed and accepted the proposed scope. Include actual Job Site components including applicable glass and sealants in test assembly . Interior finishes are not required. Construct and install components to, as nearly as feasible, simulate the actual installation in the completed structure, including reasonable representations of the profiles of adjacent building elements. Provide extra items and material as may be required to replace items and materials which might fail during the specified tests.

C. Conduct all tests in the following order and perform in accordance with the following referenced standard test methods.

1. Preliminary loading test at 20 psf.

2. Air infiltration test at 6.24 psf; ASTM E 283.
3. Water penetration by static pressure at 8 psf; ASTM E 331.
4. Water penetration by dynamic pressure at 56 mph (equal to 8 psf) wind velocity; AAMA 501.1.
5. Structural performance test with load applied at 50% of maximum design wind pressure value and 50% maximum design wind suction value specified in the "Quality Assurance" Article of this Section; ASTM E 330.
6. Air infiltration test at 6.24 psf; ASTM E 283.
7. Water penetration by static pressure at 8 psf; ASTM E 331.
8. Water penetration by dynamic pressure at 56 mph (equal to 8 psf) wind velocity; AAMA 501.1.
9. Structural performance test to demonstrate maximum wind pressure and suction values specified in the "Quality Assurance" Article of this Section times a 1.5 safety factor; ASTM E 330, except test for 10 seconds at maximum test value.
10. Test curtainwall to show that no frost or condensation will appear on interior metal surfaces exposed to view, at an outside ambient temperature of +10 degrees F and +70 degrees F inside temperature with an inside relative humidity of 35%, representing a dew point of 41 degrees F. Testing shall subject the specimen to three temperature cycles. Thermocouples shall be used to measure the surface temperature of exposed surfaces. Location of thermocouples to be determined by the laboratory, indicated on Drawings, and sent to the Architect for review prior to testing. Any reading which is below the allowed dew point temperature shall be considered a failure in design.
11. Air infiltration test at 6.24 psf; ASTM E 283.
12. Water penetration by static pressure at 10 psf; ASTM E 331.

D. Test Requirements and Procedures:

1. The requirements for air infiltration and water penetration are stated in "Quality Assurance" Article of this Section.
2. Structural Performance to Demonstrate 1.5 Safety Factor (Maximum Design Wind Pressure and Suction): Do not proceed with this test until all other tests have been satisfactorily completed. Pressure and suction test values shall be equal to 1.5 times the maximum design wind pressure and suction values. Slowly increase pressure until the required test pressure is achieved. Testing beyond the required pressure will not be required. Glass breakage, or spandrel panel failure, or permanent set within design limits specified in the "Quality Assurance" Article of this Section, will be considered failure to meet the specified requirements.
3. Construct air chamber enclosure with observation ports of sufficient size and number to permit thorough examination of all interior surfaces and joints of the test assembly during the actual test periods as per safety requirements of testing agency. Provide convenient access to these ports. Make air chamber interior accessible so that close inspections of the test assembly can be conducted during and following the water penetration and structural performance tests.
4. Use the guarded hot box method (ASTM C 236) at each representative portion of the

glazed wall system mock-up for which specific thermal performance properties are specified. Provide an air chamber of sufficient size to permit thorough examination of all interior and exterior portions of the test assembly, including access ports and vision areas in the box to permit observation of the entire test assembly while testing is underway.

4. No failures or permanent set in excess of 1/1000 will be accepted. The results of any test shall not serve, in any way, to negate the satisfactory completion of the earlier tests. Record pressures and deflections at the test pressure levels and at failure, as applicable. Describe all failures in test reports. Notify Architect of all tests revealing failure of an assembly to meet requirements.
5. As soon as practical, upon completion of testing, provide "as-built" mock-up drawings showing all modifications or additions required to meet the performance requirements.
6. In event of failure to initially meet the test requirements called for hereinabove, Contractor shall, as required, re-design, rework and/or refabricate, reship, and re-erect and retest the mock-up assembly until no failure occurs at no additional cost to the Owner. Make corrections acceptable to the Architect in those components evidencing failure and retest entire assembly until no failure occurs. Incorporate accepted corrective measures into final shop drawings and glazed wall system assemblies.
7. In the event that failures necessitate retesting, the Contractor shall pay additional laboratory fees and any other fees and expenses incurred by the Owner, Architect, Consultants, and General Contractor as a result of retesting.
8. Wherever the Contractor can demonstrate, and is willing to certify, that previous tests of the required type and ratings have been conducted successfully on his glazed wall system construction, which is substantially identical with the required work in all respects, the Architect or Owner may waive the requirements for such tests upon receipt of certified test results of such previous tests. Costs of testing will be deducted from the Contract Sum by Change Order, on acceptance of the Contractor's certified test results.

1.8 DELIVERY AND STORAGE OF MATERIALS:

A. Store materials delivered to the Site in space(s) provided by the General Contractor. Store materials neatly, properly stacked on dunnage, and protected from warping and damage. The Contractor shall not be required to move them except for installation.

1. Transport, handle, and store materials and components in a manner to preclude damage.
2. Deliver accessory materials in manufacturer's labeled containers.
3. Exercise care in handling and protect all materials and finishes during fabrication, shipment, storage, and erection as necessary to prevent damage to the finished surfaces.
4. Remove all units and components which are cracked, bent, chipped, scratched, or otherwise unsuitable for installation and replace with new, acceptable items.

1.9 SPECIAL PROJECT WARRANTY:

A. Provide written warranty as specified, signed by the glazed wall system contractor and General Contractor, agreeing to remove and replace glazed wall system work, including but not limited to, ornamental aluminum, aluminum entrance units, glass and glazing work which fail in material or workmanship. Warranty shall include removal and replacement of related work which must be removed to properly replace glazed wall system work which fails in materials or workmanship.

1. Failure of materials or workmanship includes, but is not limited to, excessive leakage or air infiltration, excessive deflections, deterioration of finish of metal in excess of normal weathering, and defects in accessories, weatherstripping, sealants, deterioration of glass coating, glass breakage resulting from thermal conditions, and other components of the work.
2. The warranty period shall be 5 years for glazed wall system work from the Date of Substantial Completion.
4. Warranty Voids: Portions of the warranty may be voided by the following events; (only the affected portions shall be voided and the balance shall remain in force):

    a. Abuse of the installation.
    b. Insufficient strength of the structure to which the glazed wall system attaches.
    c. Excessive movements of perimeter materials (non-wall system elements).
    d. Weepholes that have not been maintained clear of obstructions.

PART 2 - PRODUCTS

2.1 METALS AND RELATED COMPONENTS:

A. Aluminum Extrusions: As required to match existing and performance requirements, minimum thickness shall be 0.060" thick, unless otherwise approved by Architect. Temper and alloy as specified, unless otherwise required by "System Performance Requirements".

1. Aluminum Extrusion Alloy: 6063-T5.
2. Aluminum Sheet Alloy: 3003 aluminum alloy, temper as required.

B. Steel Materials, General: For the fabrication of metal framing work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.

1. Steel Plates, Shapes, and Bars: ASTM A 36, pickled when exposed to view.
2. Steel Pipe: ASTM A 53; type as selected; Grade A, black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise shown or specified.

3. Stainless Steel: AISI Type 302/304 with a No. 4 finish over long dimension of material.

C. Concealed Fasteners: All 1/4" diameter or less fasteners shall be series 300 stainless steel finished to match adjacent aluminum. Fasteners larger than 1/4" diameter may be cadmium and colored chromate plated and have minimum 0.0005" thick plating. Self drilling fasteners shall be "Dril-Flex" as manufactured by Elco Industries, Inc. Nuts used at expansion or moving connections shall be designed to provide a positive means of preventing disengagement. Staking or deforming of bolt threads is not acceptable.

1. All fastener penetrations and fastener heads located in front of the exterior plane of the glass shall be sealed.

D. Exposed Fasteners: No exposed fasteners permitted unless approved by Architect. Provide Phillips countersunk flat-head screws where exposed, unless otherwise accepted or required. Finish exposed fasteners to match finish of exposed aluminum in which they occur.

E. Provide aluminum brackets and reinforcements where possible. Where steel units are required for inserts, higher strength or other reason, hot-dip galvanize the units after fabrication, with 2.0 oz. zinc coating, complying with ASTM A 123.

F. Provide galvanized steel (ASTM A 36 or A 283), serrated aluminum, or serrated plastic shims.

G. Components exposed in finish work shall be completely free from warping, oil canning effects, and telegraphing of weld, studs and other fasteners.

2.2 METAL FINISHES AND PROTECTION:

A. Anodized Finishes (All Surfaces Exposed To View):

1. Clear Anodized Finish: AA-M12C22A41 (minimum thickness of 0.7 mil), medium matte chemical etch with clear anodized finish to match Architect's samples.

B. Metal Protection: Provide materials with permanent or temporary protection systems as follows:

1. Paint for Carbon Steel:

a. Concealed Parts: One shop coat of rust inhibitive primer, lead-and chromate-free, complying with FS TT-P-664.
b. Exposed Parts: Zinc rich paint, complying with SSPC - Paint 20.

2. Galvanizing of Carbon Steel:

a. Steel Sheets: ASTM A 446, Grade A, G90.
b. Hot-dipped for Shapes, Plates, Bars, and Strip: ASTM A 123.

3. Aluminum (Concealed Parts): One shop coat of zinc molybdate primer complying with FS TT-P-645.
4. Dielectric Paint Between Dissimilar Metals: Bituminous paint complying with SSPC - Paint 12, except containing no asbestos.

2.3 SEALANT MATERIALS:

A. Provide sealants at all exposed and concealed metal joints as specified in Section 079000.

2.4 FABRICATION:

A. Complete the cutting, fitting, forming, drilling, and grinding of all metal work prior to cleaning, finishing, treatment, and application of coatings. Conceal fasteners wherever possible. Fabricate and assemble components in accordance with accepted shop drawings. Deviations of any nature will not be permitted without prior acceptance of the Architect. Minor adjustments for weather integrity or strength may be suggested for Architect's acceptance. In the event of controversies over design or details, the decision of the Architect will take precedence.

B. Install each glass lite in its framed opening to match existing construction.

C. Carefully fabricate components and assemble with proper and accepted provision for thermal expansion and contraction, material and fabrication and installation tolerances, and adjoining building component tolerances and design criteria.

D. Weld aluminum by methods and with materials recommended by the aluminum manufacturer and AWS to avoid distortion and discoloration at welds. Grind exposed welds smooth and restore mechanical finish. Remove arrises from cut edges and ease edges and corners to a radius of approximately 1/64".

1. Where weld metal must be exposed before anodizing, select filler alloys to closely match the composition of the base metal. Follow parent metal manufacturer's recommendations for such filler alloys.
2. Where concealed weldments are to be made on materials that have been previously anodized or paint coated, remove anodizing or paint film in the area of fusion prior to welding. Mask parts at weld areas during anodizing or sand clean prior to welding. Crazing or discoloring of the anodizing or paint coating on the exposed areas will not be acceptable.

E. Fit and assemble the work at the shop to the greatest extent possible. Disassemble only as

required for shipment and erection. Maintain true continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.

F. Where two or more sections of metal are used in building up members, bring contact surfaces to a smooth, true, and even surface and secured together so that the joints will be weathertight without the use of pointing material. Exposed sealants, except where shown, will not be permitted. Tolerance extrusions to eliminate edge projection and misalignment at joints. Maximum misalignment between two abutting surfaces exposed-to-view shall be 1/32" including glass pockets.

G. Unless otherwise noted, provide extruded aluminum sleeve sections designed to accurately interlock with adjacent sections and incorporate serrated surfaces for the secure bedding of sealant between the parent metal and the sleeve.

H. Provide stainless steel fasteners with self-locking devices, unless otherwise noted, and of sufficient size and strength to withstand the applicable design wind load and dead load forces with safety allowance factors as required for the specific materials. Space fasteners to develop the maximum strength of the members they secure or support. Provide washers and other accessory items of the same material as the fastener. Torque tighten all assembly fasteners (except as may be required at expansion joints) to achieve the maximum torque-tension relationship in the fastener. At expansion joints, torque tighten fasteners so as to provide proper support of the expansion joint connection elements and free noiseless movement at the connection without rattling.

I. Conceal fasteners unless otherwise shown or accepted. Where exposed fasteners are approved by Architect, provide countersunk Phillips oval head type, unless otherwise indicated. Finish exposed fasteners to match surrounding metal finish.

J. Provide extruded aluminum removable members to match existing and performance requirements.

K. Use certified welders and make structural steel welds to conform to the requirements of the American Welding Society Specifications D 1.1-81 "Structural Welding Code - Steel".

1. Remove dirt, grease, lubricant, and organic materials by vapor or solvent de-greasing.
2. Repair joints rejected because of welding defects only by re-welding. Remove defective welds by chipping or machining. Do not flame cut welds.
3. Where welding is done in proximity to glass or finished surfaces, protect glass and finished surfaces from damage due to weld sparks, spatter, or tramp metal.
4. Touch up paint welds in galvanized metal with zinc rich paint.
5. Fill pinholes in welds and surface damage on all exposed surfaces of work visible under finished lighting condition when viewed from a distance of 6', with 2 component automotive body filler compatible with primer paint. Match adjacent metal surface finish

unless otherwise indicated.

2.5 FABRICATION QUALITY CONTROL:

A. Provide full access to Architect, Owner, General Contractor, and their authorized representatives to plants, shops, and assembly points to view and inspect the processes and methods employed in the fabrication, finishing, pre-assembling, and glazing (as applicable) of the glazed wall system components for this Project.

B. Provide work true to detail with sharp, clean profiles straight and free from defects, dents, marks, indentations, waves, or flaws of any nature impairing strength or appearance, fitted with proper joints and intersections and with specified finishes.

C. All items the Architect's, Owner's, or General Contractor's authorized representative notes to have any deficiency shall:

1. Be removed from production lines.
2. Not be loaded and shipped.
3. Not be installed or assembled on the Project Site until repairs or replacement parts are approved by authorized representative.

2.6 GLASS AND GLAZING:

A. All glass at curtainwall areas shall be as shown on the contract drawings, and as specified in Section 088000.

B. All glass shall be laminated, heat strengthened or tempered as required to meet wind loads, thermal stresses, or safety requirements of the governing code. Tempered glass should only be used to meet safety glazing codes. Increase glass thickness as necessary to meet other performance criteria.

C. Furnish attic stock on each glass type and reglazing accessories equal to 1% of job requirement. Sizes and exact quantities to be as selected by Architect.

D. Setting blocks of EPDM shall match existing and performance requirements.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. After lines and grades have been established by the General Contractor, but before beginning installation in any area, examine the supporting structure in the vicinity of glazed wall system work and report all conditions in writing to the General Contractor which would prevent the proper execution of the glazed wall system work or endanger its permanency.

Do not proceed with installation in the affected area until unacceptable conditions have been corrected.

1. Do not install component parts which are defective in any way, including warped, bowed, dented, abraded, and broken members. Remove and replace members which have been damaged during installation or thereafter before the time of final acceptance.
2. Do not cut, trim, weld, or braze component parts during erection, in any manner which would damage the finish, decrease the strength, or result in visual imperfection or failure in performance of the construction.
3. Install component parts level, plumb, true to line, and with uniform joints and reveals. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers, and fillers. Use erection equipment which will not mar or stain finished surfaces in any way.
4. Clean debris, dust, and other substances from behind and adjacent to the glazed wall system work as it is erected, and provide temporary closures as necessary to prevent the accumulation of such substances in the void spaces behind the glazed window wall system.

B. Provide installed glazed wall system components conforming with the following erection tolerances:

1. Maximum Deviation for Vertical Member: 1/8" maximum in story height of 13' and 1/4" maximum in a 45' run.
2. Maximum Deviation for Horizontal Members: 1/8" maximum in a 30' run.
3. Maximum offset from true alignment between 2 abutting members shall be 1/32". No edge projection or misalignment will be permitted.
4. Maximum joint gap or opening between removable glazing stop and adjacent member shall be 1/32" and/or a maximum 1/32" cumulative opening at both ends of removable member (1/64" each end).

C. Assembly and Anchorage:

1. Anchor component parts securely in place, by bolting, welding, or other permanent mechanical attachment system, which will comply with performance requirements and expected movements of adjacent parts. Install slip-joint linings wherever possible to permit such movements without detrimental affect to work.
2. Apply a bituminous coating of approximately 30 mil dry film thickness, or other suitable permanent separator, on concealed contact surfaces of dissimilar materials, before assembly or installation.

D. Set sill members and other members with joint fillers and elastomeric sealant to provide weathertight construction.

E. Perform welding by skilled mechanics qualified or licensed in accord with local building regulations and conforming to the specified practices of the American Welding Society. Thoroughly clean welds and adjoining burned areas in prime coated surfaces and paint with one coat primer, except coat welds in galvanized steel with 1 coat of zinc rich paint. Take special care to protect glass and other finished surfaces from damage and to prevent fires.

F. As required to match existing, provide flashings of the material and profiles indicated. Provide continuous flashings in longest lengths possible. Lap joints, where necessary and accepted, 12" minimum and sealed completely over the entire lapped area with sealing compound. Provide mechanical fasteners where necessary to maintain contact of over-lapping elements.

G. Permissible dimensional erection tolerances in the building frame and other work adjacent to the wall are as follows:

1. Building structural tolerances are per the AISC manual of steel construction.
2. Variation from nominal levels shown on the Drawings from the top and bottom surfaces of floor slabs and spandrel beams: plus or minus 3/4".
3. Variation from nominal location shown on the Drawings for outer faces of walls, framing members, and floor slabs: plus or minus 1".
4. The curtainwall system shall be designed to accommodate the above tolerances. All parts of the curtainwall when erected shall meet the following tolerances.

    a. Maximum variation from plane or location shown on accepted shop drawings: 1/8" per 12'-0" length or 1/2" in any total length.
    b. Maximum offset between two members abutting end to end in line: 1/32".

3.2 SEALANT INSTALLATION:

A. Use sealing materials in strict accordance with sealant manufacturer's printed instructions. Apply sealants only by mechanics specially trained or experienced in their use. Assure that sealants, tapes, gaskets, separators, joint fillers, and back-up materials are physically and chemically compatible with each other and with adjacent materials. Before applying sealant, completely remove all mortar, dirt, dust, moisture, and other foreign matter from sealant bond surfaces. Clean and prepare substrates as recommended by sealant manufacturer. Wash one small area at a time and then dry with a clean white cloth before solvent evaporates. Do not apply sealant to damp surfaces. Apply primers as required by sealant manufacturer. Mask adjoining surfaces when required to maintain a clean and neat appearance. Tool sealing compounds to fill the joint and provide a smooth finished surface.

B. Thoroughly seal all metal to metal joints between elements of glazed wall system work by buttering joints with sealant immediately prior to the final assembly of abutting sections. Clean all excess sealant from exposed surfaces.

C. Install sleeves, lugs, and related items in a full bed of sealant and seal perimeter when component is in final installed position as indicated or required by specified "Performance Requirements". Clean all excess sealant from exposed surfaces.

3.3 TESTING COMPLETED WORK:

A. Perform a minimum of 3 sets of field tests as specified for the purposes of verification of fabrication and assembly procedures providing a system complying with the specified requirements. Each set of tests shall consist of 3 separate areas.

1. Perform testing by an agent acceptable to the Architect.
2. Use testing procedures and equipment acceptable to the Architect.

B. Provide and pay for testing of the completed work for water penetration. Perform water penetration tests in accordance with the following:

1. Test Method: Follow procedures outlined in "Field Check Metal Curtain Walls for Water Leakage", AAMA Standard 501.2.
2. Tests shall be performed as follows:

    a. Perform testing by an agent acceptable to the Architect.
    b. Use testing procedures and equipment acceptable to the Architect.
    c. Testing areas shall be as accepted by Architect.
    d. Include all costs of initial test sets and all subsequent retesting, including Architect's and Owner's Representative's additional services, fees, and expenses, in the Contract Sum.
    e. Perform the first test of the first phase on the first full bay of glazed wall system installed. In the event of failure of the first full bay of glazed wall system to pass the test, the curtain wall contractor shall perform all remedial work required until the first full bay of glazed wall system passes the test. Perform the remainder of the first phase on two glazed wall unit areas with all the modifications implemented on the first test unit. All of the glazed wall system installed thereafter shall include modifications made on the glazed wall system which has passed the test.
    f. At 50% completion of entire system, perform test on full bay of glazed wall system selected by Architect. In the event of failure of this full bay of glazed wall system to pass the test, the curtain wall contractor shall perform all remedial work required until the full bay of glazed wall system passes the test. All glazed wall system previously installed and subsequently installed thereafter shall include the modifications made on the glazed wall system which has passed the test.
    g. At 75% completion of entire system, perform test on a different full bay of glazed wall system selected by Architect. In the event of failure of this full bay of glazed wall system to pass the test, the curtain wall contractor shall perform all remedial work required until this full bay of glazed wall system passes the test. All glazed wall system previously installed and subsequently installed thereafter shall include

the modifications made on the glazed wall system which has passed the test.

3. In addition, in the event that failures necessitate retesting, the aluminum curtain wall contractor shall pay the retesting cost, including fees and expenses incurred by the Owner, Architect, Consultant, and General Contractor as a result of retesting.

3.4 CLEANING:

A. Clean completed system, inside and out, promptly after erection and installation of glass and sealants (allow for nominal cure of liquid sealants). Contractor shall advise General Contractor of proper and adequate protection and cleaning procedures during remainder of construction period, so that system will be without damage and deterioration at time of acceptance.

B. Just prior to Date of Substantial Completion, clean glazed wall system thoroughly and polish glass. Demonstrate proper cleaning methods and materials to Owner's maintenance personnel.

C. Submit a "Cleaning and Maintenance Manual" listing the types of cleaning compounds, cleaning methods, and the types of sealant and glazing materials to be used for cleaning, repair, and maintenance of the work, as specified. Comply with Section 017823.

END OF SECTION

SECTION 08 70 00

FINISH HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing commercial door finish hardware for swinging doors.

1.2 PERFORMANCE REQUIREMENTS

A. Furnish, install and adjust each finish hardware item to provide proper operation and required function of every unit without binding or failure.

1. Interior Door Operating Force: Adjust hardware operation at interior non-fire-rated doors to provide an opening force not greater than 5-lbf at a point 3-inches from latch, measured to leading edge of door.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:

a. Bolts.
b. Exit devices.
c. Cylinders and keys.

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware set indicating complete designations of every item required door. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
   3. Content: Include the following information:

      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Name of product and manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.

   4. Submit data and schedule at earliest possible date, particularly where acceptance of schedule must precede fabrication of other work (e. g. hollow metal frames) that is critical to the Project construction schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Hardware units and usage specified in Part 2 of this Section and scheduled in Part 3 of this Section establish quality, quantity, function and finish required door opening. Review, coordinate and confirm that hardware specified for each opening is the proper function. In case of controversy, make appropriate notations of proposed changes from specified requirements on supplier's hardware schedule and request written clarification from the Architect prior to proceeding.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards," and Texas Accessibility Standards (TAS), as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15-lbf (67-N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Delayed-Egress Locks: Lock releases within 15-seconds after applying a force not more than 15-lbf (67-N) for not more than 3-seconds.
c. Door Closers: Not more than 30-lbf (133-N) to set door in motion and not more than 15-lbf (67-N) to open door to minimum required width.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service. Obtain written return receipt.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. General: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

1. Do not provide hardware that has been prepared for self-tapping sheet metal screws.
2. With each hardware item, furnish machine screws for installation into steel, and provide threaded-to-the-head wood screws for installation into wood; all-purpose threads are not acceptable.
3. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed screws to match the hardware finish.
4. Provide concealed fasteners for hardware units that are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners.
5. Provide through bolts for closer installation.

B. Hardware Units and Usage: Units specified below establish the design, grade, function, finish, size, and other qualities required for this Project. Provide the following hardware units in the quantities specified and locations indicated. Provide US 26D dull chrome finish unless otherwise specified.

2.2 HARDWARE UNITS AND USAGE

A. Units specified below establish the design, grade, function, finish, size, and other qualities required for this Project. Provide the following hardware units in the quantities specified and locations indicated on the Door Schedule. Provide US 26D finish unless otherwise specified. Refer to Door Schedule on Drawings for door sizes, fire ratings, hardware function, exit devices, door closers, and other requirements at each door opening.

1. Exit Devices: Provide the following at the locations shown on the Door Schedule; Von Duprin.

    a. Exit Devices shall be touchpad type, fabricated of bronze, brass, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
    b. All exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. Touchpad shall extend a minimum of one half of the door width. All latchbolts to be deadlatching type, with a self-lubrication coating to reduce wear. End-cap will install flush with the end of the device. Touchpad shall match exit device finish, and shall be stainless steel for US26, US26D, US28, US32, and US32D finishes. Only compression springs will be used in devices, latches, and outside trims or controls.
    c. Exit devices shall be UL listed panic exit hardware. All exit devices for fire rated openings shall be UL labeled fire exit hardware.

2.3 KEYING REQUIREMENTS

A. Key System Requirements: Provide construction key system in accordance with lock manufacturer's standard. Interchangeable core systems use temporary cores for construction. Emboss keys "Do Not Duplicate" and key symbol.

1. Key System (No Substitution)
2. Permanent cores shall be Best by Owner, unless otherwise required.
3. Permanent cores are to be keyed and installed by Owner, unless otherwise required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

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

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period so that, from an open position of 70-degrees, the door will take at least 3-seconds to move to a point 3-inches (75-mm) from the latch, measured to the leading edge of the door.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing glass and glazing at the following locations indicated on the Drawings.

1. Vision and spandrel lites for glazed wall system.

1.2 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

1.3 DESIGN/PERFORMANCE REQUIREMENTS

A. Design/Performance, General: Provide glazing systems that are capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

1. Ceramic-coated spandrel glass.
2. For each color (except black) of exposed glazing sealant indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

E. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in area, provide glazing products that comply with Category II materials, and for lites 9 sq. ft. (0.84 sq. m) or less in area, provide glazing products that comply with Category I or II materials.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Provide clear float and tinted float glass required, produced by one of the following primary glass manufacturers.

1. Guardian Industries Corp.
2. Pilkington North America.
3. PPG Industries, Inc.

B. Provide each type of processed glass (coated, laminated, heat strengthened, fully tempered, or insulated glass) required, produced by one of the following:

1. PPG Industries, Inc.
2. Viracon, Inc.

C. Primary Float Glass Products: Provide lites of the following annealed primary glass types conforming to ASTM C 1036, including references to type, class, quality, and if applicable, form, finish, mesh and pattern. Provide heat strengthened or fully tempered glass complying with ASTM C 1048, including references to kind, condition, type, quality and class.

1. Glass Type GL-1: Fully Tempered Clear Float Glass (vision lites): Condition A, Type I, Class 1, Quality q3, Kind FT, minimum 6-mm (0.23-inch) thick.
2. Glass Type GL-2: Fully Tempered Clear Spandrel Glass: Condition A, Type I, Class 1, Quality q3, Kind FT, minimum 3/8" thick, with manufacturer's standard opacifier backing. Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.

2.2 GLAZING GASKETS

A. Dense Compression Gaskets: Shall match existing. Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal.

1. Neoprene, ASTM C 864.

2.3 MISCELLANEOUS GLAZING MATERIALS

A. Sealants, Tapes and Backup Materials: Provide sealants, tapes and backup materials of proven compatibility with other materials that they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience. Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation. Provide the following chemical curing, elastomeric sealants of the base polymer and movement capability indicated.

1. Non-Structural Silicone Glazing Sealant: One-part medium modulus silicone sealant with minimum ±50% joint movement capability and conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, A, and as applicable to use indicated, O. Acceptable manufacturer and product includes General Electric Company "Silglaze II," or Dow Corning "Dow Corning 795."

2. Translucent Silicone Sealant: One-part medium modulus translucent silicone sealant with minimum ±25% joint movement capability and conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, A, and as applicable to use indicated, O. Acceptable manufacturer and product includes General Electric Company "SCS 1201," or Dow Corning "Dow Corning 799."
3. Glazing Tape: AAMA 806.3, 100% solids butyl tape with spacer rod; Tremco "Polyshim II" or PTI "PTI 303 Glazing Tape," except use glazing tape lite kits applicable to UL Listed (UBC 7-2 1997 and UL 10C) fire-rated glazing assembly time ratings as produced by Zero International, or equivalent and specified as part of Section 087000 - Door Hardware work.
4. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

B. Miscellaneous Glazing Materials: Provide products of material, size and shape complying with the referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with proven record of compatibility with surfaces contacted in installation.

1. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
2. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
3. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Sizes, Clearances, Bite and Tolerances: Fabricate glass to the sizes required for glazed openings indicated, with edge and face clearances, bite and tolerances complying with recommendations of glass manufacturer and the referenced glazing standard, to comply with performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Inspect each piece of glass immediately before installation, and remove lites that have observable edge damage or face imperfections from the Project Site.

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

3.2 GLAZING PREPARATION

A. Clean framing members to receive glass, immediately before glazing. Remove coatings that are not firmly bonded to the substrate.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Center glass lites in each opening. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:

1. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
2. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 09 29 00

GYPSUM DRYWALL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes furnishing and installing:

1. Screw type steel drywall framing.
2. Gypsum drywall board.
3. Gypsum drywall accessories.
4. Gypsum drywall finishing.

1.3 SUBMITTALS

A. Product Data: Submit product data for each drywall material and accessory required, including specifications showing compliance with requirements.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. Metal Support Materials;

   a. Clark Dietrich Building Systems.
   b. Clark Framing Systems
   c. Gold Bond Building Products Div., National Gypsum Co.

2. Gypsum Board and Related Products:

   a. G-P Corp.
   b. Gold Bond Building Products Civ., National Gypsum Co.
   c. USG.

2.2 FRAMING AND SUPPORT SYSTEMS

A. Screw Type Steel Studs and Runners: ASTM C 645, fabricated from minimum 0.0179" thick zinc coated steel in sizes indicated. Provide 1-1/2" x 1-1/2" angle runner at perimeter of ceiling suspension panels for support of drywall panel edge and extruded aluminum ceiling panel edge closure trim.

2.3 BOARD MATERIALS

A. Gypsum Drywall Board: ASTM C 1396, 5/8-inch thick,Type X fire rated, unless otherwise shown.

2.4 MISCELLANEOUS MATERIALS, ACCESSORIES, AND TRIM

A. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

B. Galvanized steel casing beads, corner beads, and other metal trim accessories as required.

C. Joint Tape: ASTM C 475, plain or perforated.

D. Interior Joint Compound: ASTM C 475 in two grades; one for bedding tape and filling depressions and one for topping and sanding.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Acceptable Products: US Gypsum "Thermafiber Sound Attenuation Blanket" or Owens-Corning "Sound Attenuation Batts".

F. Acoustical Sealant: See Section 07 90 00 – Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation, except as follows:

1. Partitions with Brittle Finishes: Use stud manufacturer's published limiting heights for construction and single span conditions with a limiting deflection of L/360 and uniform transverse load values as indicated on the Drawings.
2. Partitions without Brittle Finishes, More Than 10'-0" High: Use stud manufacturer's published limiting heights for construction and single span conditions with a limiting deflection of L/240 and uniform transverse load values as indicated on the Drawings.
3. Do not bridge building expansion joints with support system. Frame both sides of joints with supports as indicated.

4. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by US Gypsum Co.
5. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
6. Install runner tracks at floors, ceilings, and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
7. Terminate partition stud system at ceilings, except where indicated to be extended to structural support or substrate above.
8. Space studs 16" o.c., unless otherwise indicated.
9. Frame door openings to comply with details indicated. If not shown, comply with applicable published recommendations of gypsum board manufacturer or of "Gypsum Construction Handbook" published by U. S. Gypsum Co. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.
10. Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. Form control and expansion joints with space between edges of adjoining gypsum panels.

H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
4. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
5. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
6. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
7. Corridors:
   a. At all corridor partitions, smoke-stop partitions, horizontal exit enclosures, and fire walls, permanently mark both sides of wall construc¬tion above ceilings with the words "Fire and Smoke Barrier Do Not Penetrate". Use stencils and paint letters 3" high with message repeated every 10’-0” o.c. unless otherwise required by applicable Code.

3.4 SINGLE LAYER APPLICATION

A. Partition/Walls: Apply gypsum board vertically with vertical joints located over supports, but offset at least one stud space on opposite faces of partition/walls. Use maximum practical length boards to minimize end joints.

3.5 INSTALLATION OF DRYWALL TRIM AND ACCESSORIES, GENERAL

A. Where feasible, use the same fasteners, to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

1. Install metal corner beads at external corners of drywall work.
2. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
3. Install extruded aluminum trim at locations indicated. Cope and miter joints for neat appearance without voids.

3.6 FINISHING GYPSUM BOARD ASSEMBLIES

A. Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

B. Exposed Drywall to Receive Paint and Other Finishes: Apply joint compound in 3 coats (not including prefill of openings in base), and sand between last two coats and after last coat.

C. Concealed Drywall: Omit third coat and sanding on concealed drywall work which is not indicated for drywall finishing or for which finishing is not required to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

D. Provide the following levels of gypsum board finish per ASTM C 840 and GA-214:

1. Level 0: Gypsum board within unfinished areas; taping, floating and trim is not required.
2. Level 1: Gypsum board within ceiling plenum areas, concealed areas, unless a higher finish is required for fire resistance rated assemblies and sound rated assemblies.
3. Level 2: Gypsum board substrates to receive ceramic tile and similar solid finish materials.

4. Level 3: Gypsum board ceiling and wall surfaces specified to receive flat and satin paint or heavily textured wall coverings over non-textured surfaces.
5. Level 4: Gypsum board wall surfaces to receive flat or semi-gloss paint and light textured wall coverings.
6. Level 5: Gypsum board ceiling and wall surfaces specified to receive gloss paint and other reflective applied finishes over non-textured surfaces.

E. At all corridor partitions, smoke-stop partitions, horizontal exit enclosures, and fire walls, permanently mark both sides of wall construction above ceilings with the words "Fire and Smoke Barrier - Do Not Penetrate". Use stencils and paint letters at least 1" high with message repeated every 10’-0” o.c. unless otherwise required by applicable Code.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing:

1. Use existing exposed tee suspension system and new acoustical panels as scheduled.
2. Acoustical ceiling trim and accessories to match existing.
3. Additional hanger wires to support mechanical and electrical fixture that bear on suspension grid.

1.2 DESIGN/PERFORMANCE REQUIREMENTS:

A. Comply with ASTM C 635 for materials and ASTM C 636 for installation. Where fire rated assemblies are indicated, comply with the requirements of the UL designs shown.

1.3 SUBMITTALS

A. Submit manufacturer's product data and samples showing compliance with specified requirements.

1.4 QUALITY ASSURANCE

A. Acoustical Panel Standard: Comply with ASTM E 1264.

B. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.

C. Fire-Test-Response Characteristics:

1. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84 and a smoke-developed index of 450 or less.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed, but not fewer than two full cartons.

PART 2 - PRODUCTS

2.1 CEILING SUSPENSION GRIDS

A. Acceptable existing suspension system shall be reused to the greatest extent possible; if necessary provide additional suspension system materials to match existing.

2.2 ACOUSTICAL PANELS

A. Acoustical Lay-In Panels as scheduled on the Drawings, or equal by USG Corporation, or CertainTeed.

PART 3 - EXECUTION

A. General: Install acoustical panel ceilings to comply with ASTM C 636, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit. Install square edge panels to rest on flanges of grid tees with border units supported by moldings. Install acoustic units in accordance with manufacturer's printed applicable instructions and recommendations only when:

1. Exterior openings have been closed and roofs are weathertight.
2. Mechanical, electrical, and other work above ceilings has been completed.
3. Wet work has been installed.
4. Temperature and relative humidity levels comply with acoustic material manufacturer's recommendations.

C. Cleaning and Repairs: Clean exposed surfaces; comply with manufacturer's instructions. Remove and replace damaged units and members.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing and installing:

1. Resilient vinyl tile.
2. Resilient base.

1.2 RELATED WORK

A. Coordinate work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Submit seaming plans for sheet vinyl and other types for resilient flooring with intricate patterns and where flooring joints between color are not indicated on the Drawings.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: Full-size units of each color and pattern of resilient flooring required.

1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12-inches (300-mm) long, of each resilient product color and pattern required.
2. Architect's approval will be for color and texture only; compliance with other requirements is Contractor's exclusive responsibility.

E. Maintenance Data: For resilient products to include in maintenance manuals.

F. Attic Stock Material: Furnish a minimum 240-sf (22.3-m^2) of each type vinyl composition tile and 120-lf (36.6-m) of each type of resilient base in manufacturer’s unopened containers.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50-degrees F (10-degrees C) or more than 90-degrees F (32-degrees C). Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70-degrees F (21-degrees C) or more than 95-degrees F (35-degrees C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 55-degrees F (13-degrees C) or more than 95-degrees F (35-degrees C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48-hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Rubber Base: ASTM F 1861, Type TS; 4-inch (100 mm) high, 1/8-inch (3-mm) thickness, standard topset cove thermoset vulcanized rubber base at resilient flooring. Roppe or as indicated on Finish Legend and Finish Schedule.

B. Vinyl Composition Tile Flooring: See Finish Legend and Finish Schedule.

2.2 ACCESSORY MATERIALS

A. Self-Leveling Underlayment: Ardex "K-15", Cormix "Corlevel", or Sonneborn "Sonoflow" including bonding agent (if any) recommended by underlayment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which resilient flooring and accessories are to be installed and do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

B. Confirm that concrete has cured a minimum of 60-days prior to scheduling installation of flooring and that no rain or water from all sources has been allowed to stand on concrete floor areas scheduled to receive flooring materials for a minimum of 30-day prior to flooring installation.

C. Moisture Vapor Emission Tests: ASTM F2170.

D. pH Tests: Two days prior to scheduled flooring installation date, test each 1,000-sq. ft. (92.9-m^2) of flooring substrate, or portion thereof to determine the pH of concrete substrates to receive flooring has a pH of about 9.0 in accordance with ASTM F 710.

1. Confirm that tests of pH levels are within limits permitted by flooring adhesive manufacturer prior to installation of flooring.
2. Do not grind, shot blast, or perform similar operations that will remove the top surface of cured concrete substrates scheduled to receive flooring unless specifically recommended by the flooring adhesive manufacturer in writing to correct a specific concrete substrate deficiency.

3.2 PREPARATION

A. Prior to laying flooring, vacuum-sand concrete and wood floor surfaces to be covered and inspect subfloor. Start of flooring installation will indicate acceptance of subfloor conditions and full responsibility for completed resilient flooring work. Patch holes and defects in existing substrates indicated to receive resilient flooring materials.

B. Apply adhesive primer, as recommended by flooring manufacturer, prior to application of adhesive.

3.3 TILE INSTALLATION

A. Install flooring after finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of subflooring, building air-temperature, and relative humidity shall be within limits recommended by flooring manufacturer.

B. Place flooring with adhesive cement in strict compliance with flooring and adhesive manufacturer's printed instructions. Butt tightly to vertical surfaces, thresholds, nosings, and edgings. Scribe around obstructions to produce neat, tight, even, and straight joints. Extend flooring into toe spaces, door reveals, and into closets and similar openings.

C. Tightly cement flooring to subbase without open cracks, voids, raising, and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

D. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are equal width. Adjust to avoid use of cut widths less than 3" wide at room perimeters. Lay tile square to room axis.

E. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped, or deformed tile will not be acceptable.

F. Lay tile with grain in the same direction as directed by Architect; basket weave installation is not acceptable.

3.4 INSTALLATION, ACCESSORIES

G. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips to all unprotected edges of flooring.

3.5 CLEANING AND PROTECTION

A. Remove excess adhesive and other surface blemishes from flooring and base, using types of cleaners as recommended by flooring manufacturer.

B. Protect installed flooring from damage by covering with approved coverings.

C. Finishing: Just prior to final inspection of the Work, thoroughly clean base and floors and accessories and apply type of wax and buff as recommended in resilient flooring manufacturer's printed instructions for proper care and finishing of resilient flooring furnished.

END OF SECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Steel and iron.
   2. Galvanized metal.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

G. MPI: Master Painters Institute.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 1 gal. (3.8 L) of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Coronado; division of Benjamin Moore & Co.
2. PPG Architectural Coatings.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Alkyd System MPI EXT 5.1D:

a. Prime Coat: Primer, alkyd, anticorrosive, for metal, MPI #79.
b. Prime Coat: Primer, metal, surface tolerant, MPI #23.

c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.

d. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), MPI #9.

B. Galvanized-Metal Substrates:

1. Alkyd System MPI EXT 5.3B:

a. Prime Coat: Primer, galvanized, cementitious, MPI #26.

b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 5), MPI #8.

d. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), MPI #9.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. MPI: Master Painters Institute.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current “MPI Approved Products List” for each product category specified, with the proposed product highlighted.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

1.4 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for

application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Coronado, by Benjamin Moore.
2. PPG Architectural Finishes, Inc.
3. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its “MPI Approved Products Lists.”

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

D. Colors: As indicated in a color schedule or if not indicated as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in “MPI Architectural Painting Specification Manual” applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in

"MPI Architectural Painting Specification Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.3 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Gypsum Board Substrates:

1. Latex over Latex Sealer System MPI INT 9.2A:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.

END OF SECTION

SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrate:

1. Exterior Substrates:

a. Concrete, non-pedestrian or vehicular horizontal surfaces.

1.2 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

D. MPI: Master Painters Institute.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 1 gal. (3.8 L).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. PPG Architectural Coatings.
2. Sherwin-Williams Company (The).
3. Tnemec Inc.
4. Coronado; div. of Benjamin Moore & Co.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: Gray color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Horizontal Surfaces:

1. Pigmented Polyurethane over Epoxy System MPI EXT 3.1M:

    a. Prime Coat: Epoxy, matching intermediate coat.
    b. Intermediate Coat: Epoxy, gloss, MPI #77.

    c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

END OF SECTION

SECTION 11 12 00

PARKING CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes parking control equipment as shown on the Drawings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for parking control equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties.

B. Shop Drawings: For parking control equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Vehicle Detectors: Layout and method of placement of vehicle loop detector system.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For parking control equipment to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Gate Arms: Two breakaway gate arms for each gate installed, complete with accessory components.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Parking Control System: For the types of parking management indicated. Provide system that will allow EZ-tag reader to communicate with parking control system.

B. Provide the following:
1. Readers: TransCore “Encompass 4 Reader”:
   a. Frequency Range 902 to 928 MHz capable. Comply with Part 15 of FCC, Class A; UL compliance, complete with all accessories, cables, wiring, brackets, for a complete operating system.
2. Cypress Converter PCBH CVX-1496.
3. Base LD-1150-LV Loop Detectors.
4. NEMA-4 12” x 12” x 6” enclosure.
5. Vehicle loop detector.
6. Traffic buttons, approximately 12, lane delineation.
7. Federal Signal Exit Warning Audible/Light.
8. Altronix Timer module to control Exit Warning.
9. Barrier Gates: Magnetic Autocontrol type.

10. All required electrical wiring and accessories.

C. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 AUTOMATIC BARRIER GATES

A. General: Provide parking control device consisting of operator and controller housed in a weathertight, tamper-resistant cabinet enclosure with gate arm. Device shall be activated by a signal from access or revenue control device. Fabricate unit with gate-arm height in down position of not more than 35 inches (889 mm) above pavement.

B. Standards: ASTM F 2200 for barrier gates and gate operators that are listed and labeled according to UL 325 by a qualified testing agency.

C. Controller: Factory-sealed, solid-state, plug-in type, with galvanized-steel box for wiring connections.

1. Type: As indicated.

D. Cabinets: As specified.

E. Gate Arm: As specified. Class IV, for restricted access.

F. Operator: UL labeled and listed, as indicated.

G. Characteristics: Refer to Drawings.

2.3 VEHICLE DETECTORS

A. General: Provide detection devices that sense presence or transit of vehicles and emit signals activating gate-arm operators. As indicated on Drawings.

B. Vehicle Loop Detector System: As specified.

2.4 TRAFFIC CONTROLLERS

A. General: Provide directional enforcement system that allows passage of vehicle in only one direction as indicated.

2.5 ANCHORAGES

A. Anchor bolts; hot-dip galvanized according to ASTM A 153/A 153M and ASTM F 2329.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before parking control equipment installation.

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

3.2 INSTALLATION

A. General: Install parking control equipment as required for complete and integrated installation.

1. Rough-in electrical connections.

B. Automatic Barrier Gates: Anchor cabinets to concrete bases with anchor bolts or expansion anchors, and mount barrier gate arms.

1. Install barrier gates according to UL 325.

C. Vehicle Loop Detectors: Refer to Drawings for cutting grooves or burying and seal wire loop at locations indicated on Drawings according to manufacturer's written instructions. Connect to parking control equipment operated by detector.

D. Traffic Controllers: Anchor controllers to surfaces with anchor bolts or expansion anchors, unless otherwise indicated.

E. Attach cabinets to concrete bases with anchor bolts or expansion anchors.

F. Connect wiring and ground equipment according to Division 26.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Parking control equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust parking control equipment to function smoothly, and lubricate as recommended by manufacturer.

B. Confirm that locks engage accurately and securely without forcing or binding.

C. After completing installation of exposed, factory-finished parking control equipment, inspect exposed finishes and repair damaged finishes.

3.5 PROTECTION

A. Remove barrier gate arms during the construction period to prevent damage, and install them immediately before Substantial Completion.

3.6 SOFTWARE SERVICE AGREEMENT

A. Technical Support: As agreed by Owner, beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION

A. Train maintenance personnel to adjust, operate, and maintain parking control equipment.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Common work results for requirements specifically applicable to Division 23.

B. Requirements of Division 01 Specifications, General Provisions of the Contract and General and Supplementary Conditions apply to this Division.

1.2 REFERENCES

A. AGA: American Gas Association.

B. ANSI: American National Standards Institute.

C. ARI: American Refrigeration Institute.

D. ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers.

E. 2012 International Building Code with City of Houston Amendments.

F. 2012 International Fire Code with City of Houston Amendments.

G. 2012 Uniform Mechanical Code with City of Houston Amendments

H. 2012 Uniform Plumbing Code with City of Houston Amendments.

I. 2009 International Energy Code with City of Houston Amendments.

J. ASME: American Society for Mechanical Engineers.

K. ASTM: American Society for Testing and Materials

L. AWWA: American Water Works Association.

M. FM: Factory Mutual

N. IRI: Industrial Risk Insurers

O. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.

P. NEMA: National Electrical Manufacturers' Association.

Q. NFPA: National Fire Protection Association.

R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

S. UL: Underwriters' Laboratories, Inc.

T. U.L. Fire Resistance Index

U. ASTM E814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.3 QUALITY ASSURANCE

A. All work shall be performed in accordance with the latest edition of the applicable codes, specifications, local ordinances, industry standards, utility company regulations, and nationally accepted codes.

B. All materials, distribution, and utilization equipment shall be UL Listed.

C. All equipment and materials shall be new, unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.

D. Any and all abnormal sources of noise shall be eliminated noted by the Architect or Engineer not to be an inherent part of the systems as designed without additional cost to the Owner.

1.4 PROJECT/SITE CONDITIONS

A. Layouts indicated on drawings are diagrammatical and intended to show relative positions and arrangement of equipment, ductwork and piping. Coordinate mechanical work with other trades and measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings, using as necessary rises, drops, offsets, transitions, and alternate routings to fit in the available space unless prevented by Project conditions.

B. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.

C. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

D. Determine sizes and verify locations of existing utilities on or near site.

E. Keep roads clear of materials and debris.

F. Visit site and be informed of conditions under which Work must be performed.

1.5 DRAWINGS

A. The Contract Documents depict HVAC systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. The drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the HVAC equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment that the Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of pipes and ducts, or to indicate all offsets and fittings or supports, but rather to indicate approximate layout.

C. The HVAC Drawings are necessarily diagrammatic in character and cannot show every connection in detail in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

D. When the HVAC Drawings do not give exact details as to the elevation of pipe, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed piping is generally intended to be installed true and square to the building construction, and located in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

E. Catalog numbers referenced throughout the Division 23 Drawings and

Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

1.6 SUBMITTALS

A. Provide shop drawings and complete product data as indicated in each specification section.

B. Coordination Drawings: Using the HVAC shop drawings as a basis, provide a composite set of AutoCAD drawings in which the major HVAC equipment, ductwork and piping are superimposed on the architectural plan and structural framing plan. Include spot elevations of bottom of steel along with finished ceiling height. Prepare at 1/8 inch scale or larger, one drawing per building area. Provide 1/4 inch scale enlargements of locations where special attention to rough-in dimensions as required to ensure all systems will fit within the available space. Obtain approval of coordination drawings prior to duct fabrication and mechanical system hanger rough-ins.

C. Shop Drawings and Submittals will be reviewed and returned to the Contractor with one of the following categories:
   1. **No Exceptions Taken**: No further submittal action is required. Submittal to be included in O & M Manual.
   2. **Revise and Resubmit**: Contractor to resubmit submittal as indicated in comments section of Engineer's Submittal Cover Letter.
   3. **Rejected**: Contractor to resubmit new submittal when alternate or substitution is not approved and be required to furnished product named in Specification and or Drawings.
   4. **Furnish as Corrected**: Contractor to submit letter verifying that required corrections noted on Engineer's Submittal Cover Letter have been received and complied with by manufacturer. If equipment on site is not in compliance with corrections noted, contractor shall be responsible for the cost of removing and replacing equipment.

D. Materials and equipment which are purchased or installed without Submittal review and approval will be removed and replaced with specified equipment at Contractor's expense.

E. Provide a specification review that consists of a copy of related specification section with notations indicating compliance or deviation with each element of specification.

1.7 RECORD DRAWINGS

A. Provide record drawings that illustrate the work of Division 23 as finally constructed. Deliver record drawings to the Architect in a form suitable for production.

B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.

C. Deliver record drawings to Architect within 30 days of Substantial Completion.

1.8 OWNING AND OPERATING MANUALS

A. Provide electric motors, control panels, certain control and safety devices and control wiring when specified or required for proper operation of electrical systems associated with mechanical equipment specified in Division 23.

B. Electrical materials and work provided shall be in accordance with Division 26.

C. Notify Architect/Engineer in writing 14 days before bids are due if it is necessary to increase horsepower of any motors or change any electrical requirements listed or shown. After this period, costs incurred because of changes shall be assumed by the responsible Contractor.

1.9 GENERAL ELECTRICAL REQUIREMENTS

A. Comply with the requirements of Division 01, but provide a minimum of three sets.

B. Manuals shall include clear and comprehensive instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division Notify Architect/Engineer in writing 14 days before bids are due if it is necessary to increase horsepower of any motors or change any electrical requirements listed or shown. After this period, costs incurred because of changes shall be assumed by the responsible Contractor.

C. Copies of final reviewed submittals indicating all model numbers, serial numbers, cut sheets, and all performance criteria on furnished equipment shall be included.

1.10 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Mechanical equipment with factory assembled and/or attached electric equipment shall be Underwriters' Laboratories (UL) listed as an assembly when such listing is available from UL, and shall meet the latest edition of the National Electrical Code.

B. Unless otherwise specified, the electrical supply being furnished is a 460 volt, 3 phase, 3 wire, 60 hertz source. No neutral connection is available from the 460 volt source. The manufacturer shall include any transformers for equipment requiring other voltages (220 volt, 120 volt, 24 volt, etc.).

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Provide all required connections to maintain existing systems in service during construction.

B. When performing work on operating systems use personnel experienced and trained in similar operations.

C. Remove, relocate, and extend existing installations to accommodate new construction.

D. Repair adjacent construction and finishes damaged during demolition and extension work.

E. Normal facility activities will continue in existing areas. MEP systems servicing existing occupied spaces will have to be maintained in service. Schedule any required outages and system service interruptions with Owner and Architect. Submit a written request indicating service(s) to be interrupted along with proposed duration and summary of work to be performed during downtime.

F. Removed Equipment:
1. Store removed items at site; Owner retains rights to all removed items.
2. Allow Owner ample time to review removed items and to designate which items to be kept by Owner.
3. Dispose properly, off-site, all items Owner chooses not to keep.

3.2 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Repair or replace damage caused by cutting or installation of work specified in Division 23. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.3 DELIVERY, STORAGE AND PROTECTION

A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where deliver in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.

B. Store items in a clean, dry place, and protect from damage. Mechanical equipment may not be staged or stored outdoors unless intended for outdoor use.

C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.

D. Protect valves and piping from damage. Cover equipment during work of finishing trades.

E. Keep dirt and debris out of pipes and ducts.

F. Repair, restore, and replace damaged items.

G. Cover factory finished equipment during work of finished trades, such as fan coils, fin tubes, etc.

H. Protect cooling and/or heating coils with temporary filter media during construction.

3.4 OPERATION OF HVAC SYSTEMS DURING CONSTRUCTION

A. Install specified filters prior to system operation. In addition to specified filters, install a roughing filter upstream of mixed air filter. Roughing filter shall consist of two layers of roll filter media clipped and sealed to entering side of filter frame. Change roughing filter as necessary to minimize dust collection on specified filters.

B. Cover return and exhaust air grilles with temporary filter media. Attach media to avoid damage to grille or ceiling. Change temporary media as required to protect against dust buildup on ductwork. Remove temporary media from grilles after flooring is installed, walls are sanded and painted and other dust generating construction has been completed.

C. During periods of excessive dust generation such as drywall sanding, seal off return and exhaust openings and grilles to prevent dust from accumulating in ductwork.

D. If outside air source contains less dust than building air, adjust A/C unit dampers to operate with as much outside air as possible without causing a freezing condition for coil or exceeding capacity of coil to adequately condition supply air.

E. Furnish and install a new set of specified filter media prior to start of system test and balance. Furnish a new, clean set of the specified media and turn over to Owner's Representative

3.5 TESTING MECHANICAL SYSTEMS

A. Test all systems and equipment installed to demonstrate proper operation.

B. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.

C. Correct and retest work found defective when tested.

D. Make repairs to piping systems with new materials. Peening, doping, or caulking of joints or holes will not be acceptable.

E. System Balance and Testing: Prepare to assist test and balance firm by assuring systems are complete and operational.

3.6 OWNER INSTRUCTION - GENERAL

A. Provide on-site Owner training for all new equipment by factory trained specialists.

B. Use Operation and Maintenance manuals and actual equipment installed as basis for instruction.

C. At conclusion of on-site training program have Owner personnel sign written certification they have completed training and understand equipment operation.

Include copy of training certificates in final Operation and Maintenance manual submission.

D. Refer to individual equipment specifications for additional training requirements.

3.7 INFECTION CONTROL

A. Coordinate with the Owner the exact requirements for the infection control measures to be executed and performed during the course of this Project.

B. Prior to execution, present to the Owner for approval a written execution plan for each infection control measure.

C. Coordinate infection control measures as needed with all other trades and disciplines.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Chilled-water piping, indoors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

    a. Pittsburgh Corning Corporation; Foamglas.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 1290, Type I.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000-Degree Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Knauf Insulation; Permawick Pipe Insulation.
   b. Owens Corning; VaporWick Pipe Insulation.

J. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armacell LLC; Tubolit.
b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F

1. Products: Subject to compliance with requirements, provide the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 739, Dow Silicone.
    b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    c. P.I.C. Plastics, Inc.; Welding Adhesive.
    d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements, provide the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products: Subject to compliance with requirements, provide the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

7. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. , in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
    b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    c. RPR Products, Inc.; Insul-Mate.

2. Sheet and roll stock ready for shop or field sizing
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper
5. Factory-Fabricated Fitting Covers:

    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.

e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film.

F. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches
3. Thickness: 11.5 mils
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches
3. Thickness: 6.5 mils
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches
3. Thickness: 3.7 mils
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

D. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches
3. Film Thickness: 4 mils
4. Adhesive Thickness: 1.5 mils
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch or 3/4 inch wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel

1. Manufacturers: Subject to compliance with requirements, provide the following:

a. C & F Wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.

3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.9 FINISHES

A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Chilled Water and Brine, above 40 Deg F : Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC 30 mils thick

D. Piping, Exposed:

1. Aluminum, Smooth, 0.024 inch thick.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:
   1. Chilled-water piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:

   1. Plastic pipe and fittings with solvent cement.
   2. RTRP and RTRF with adhesive.
   3. Pressure-seal fittings.

B. Delegated-Design Submittal:

   1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
   2. Locations of pipe anchors and alignment guides and expansion joints and loops.
   3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
   4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
   1. Chilled-Water Piping: 200 deg F

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L and ASTM B 88, Type M

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.

   1. Manufacturers: Subject to compliance with requirements, provide products by the following:

      a. Anvil International, Inc.
      b. Star Pipe Products.
      c. Victaulic Company.

   2. Grooved-End Copper Fittings: ASTM B 75 copper tube or ASTM B 584, bronze casting.
   3. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Central Sprinkler Company.
c. Star Pipe Products.
d. Victaulic Company.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Charlotte Pipe and Foundry Company.
    b. IPEX Inc.
    c. KBI (King Bros. Industries).

2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Charlotte Pipe and Foundry Company.
    b. IPEX Inc.
    c. KBI (King Bros. Industries).
    d. NIBCO INC.

2. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

   a. A.Y. McDonald Mfg. Co.
   b. Capitol Manufacturing Company.
   c. Central Plastics Company.
   d. Hart Industries International, Inc.
   e. Jomar International, Ltd.
   f. Matco-Norca.
   g. Watts Regulator Co.
   h. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 150 psig
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be the following:

1. Type L or Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install shutoff valve immediately upstream of each dielectric fitting.

3.3 FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

B. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet
4. NPS 2: Maximum span, 10 feet
5. NPS 2-1/2: Maximum span, 11 feet
6. NPS 3 and Larger: Maximum span, 12 feet

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch

D. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.6 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 23 21 16

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special-duty valves and specialties for the following:
   1. Chilled-water piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:

   1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   2. Air-control devices.
   3. Hydronic specialties.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
   1. Chilled-Water Piping: 150 psig at 200 deg F

2.2 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping.

B. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump.
    c. Flow Design Inc.
    d. Gerand Engineering Co.
    e. Griswold Controls.
    f. Nexus Valve, Inc.
    g. Taco.
    h. Tour & Andersson; available through Victaulic Company.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

C. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.

5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flow Design Inc.
    b. Griswold Controls.
    c. Nexus Valve, Inc.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.

5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig
9. Maximum Operating Temperature: 250 deg F

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shut off duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

END OF SECTION

SECTION 26 00 10

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Documents, General Requirements for Building Construction and Related Work, apply to work specified in all Division 26 sections.

1.2 GENERAL

A. Each section included in Division 26 - Electrical incorporates this section by reference and is incomplete without the provisions stated herein.

B. Coordinate work included in other Divisions which affect the work in this Division.

1.3 DEFINITIONS

A. Provide: Where the word "provide" is used, the word is understood to mean "the Contractor shall furnish and install" the equipment, tests, inspections, etc. referenced.

B. Related Work: The sections referenced under the paragraph RELATED WORK are understood to include provisions which directly affect the work being specified in the section where the RELATED WORK paragraph occurs.

C. Concealed: Where the word "concealed" is used in conjunction with raceways, equipment and the like, the word is understood to mean hidden from sight as in chases, furred spaces or suspended ceilings.

D. Exposed: Where the word "exposed" is used, the word is understood to mean open to view.

1.4 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Foundations and pads required for equipment furnished under this Division

B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting

C. Automatic Gate operators

D. Irrigation System equipment

E. Cutting and patching for electrical Work, except for errors and omissions under this Division.

RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

A. Security System equipment

1.5 CODES STANDARDS AND PERMITS

A. Perform work in accordance with the latest editions, revisions, amendments or supplements of applicable statues, ordinances, codes or regulations of Federal, State and Local Authorities Having Jurisdiction in effect on the date bids are received.

B. Where standards have been established by OSHA, Underwriter's Laboratories, American Codes, ADA, ASME, AGA, AMCA, ASA, ARI, NEC, State Fire Insurance Regulatory Body, and FM, these standards shall be followed whether or not indicated on the Contract Drawings and Specifications. Include the cost of all work required to comply with the requirements of these authorities in the original proposal. Comply with ANSI C2 where applicable.

C. Requirements in reference specifications and standards are minimum for all equipment, material and work. In instances where capacities, size or other features of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

D. Resolve any code violation discovered in contract documents with the Architect/Engineer prior to award of the contract. After award of the contract, make any correction or addition necessary for compliance with applicable codes, at no additional compensation.

E. Arrange with local and state authorities and utility companies for permits, fees and service connections, verifying locations and arrangement, and pay all charges including inspections.

F. Perform Work specified in Division 26 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.

1. NFPA 30: Flammable and Combustible Liquids Code
2. NFPA 70: National Electrical Code

3. NFPA 75: Standard for Protection of Information Technology Equipment
4. NFPA 241: Standard for Safeguarding Building Construction, Alterations, and Demolition Operations
5. NFPA 418: Standard for Heliports
6. NFPA 780: Standard for the Installation of Lightning Protection Systems
7. NFPA 5000: Building Construction and Safety Code
8. ANSI Handicapped Code-A117.1
9. ASTM E814-08B: Standard Test Method for Fire Tests Penetration Firestop Systems.
10. U.L. Fire Resistance Index.
11. UL White Book: General information for electrical construction, hazardous location, and electrical heating and air conditioning equipment
12. International Building Code
13. City of Houston Electrical Code
14. State of Texas Electrical Code
15. State of Texas Architectural Barriers Code
16. All applicable Occupational Safety and Health Administration (OSHA)
    1. Publications, Rules and Regulations.
17. Americans with Disabilities Act (ADA)

1.9 CONTRACT DRAWINGS

A. The contract drawings are generally diagrammatic and are intended to encompass a system that will not interfere with the structural and architectural design of the building. Coordinate the work to avoid interferences between conduit, equipment, architectural and structural work.

B. Coordinate with architectural features, trim and millwork details, and install equipment in cabinets or other special areas as directed by the Architect/Engineer.

C. Contract drawings are based on the equipment specified. Make adjustments, modifications or changes required, due to use of other equipment, at no additional compensation.

1.10 PROJECT/SITE CONDITIONS

A. Site Visitation: Visit the site of the proposed construction to thoroughly become familiar with all details of the work and working conditions, verify all dimensions in the field, and advise the Architect/Engineer of any discrepancy before performing any work.

B. Space Requirements

1. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material which is not suitable in this respect.

2. Make changes in equipment location of up to 10 feet, to allow for field conditions prior to actual installation, at no additional compensation, as directed by Architect/Engineer.

3. Conceal all conduit in finished areas. Conduit may be exposed in mechanical rooms, electrical rooms and where specifically allowed on the drawings. Route conduit throughout the space without interfering with other Contractor's equipment or construction.

4. Provide maximum possible clear height underneath all conduits. Install conduit as high as possible.

5. Install all equipment requiring service so that it is easily accessible.

6. Compare the equipment sizes with the space allotted for installation before installation and make written notice of possible conflict. Disassemble large equipment to permit installation through normal room openings when required. Should written notice not be made in a timely manner, make adjustments and modifications necessary without additional compensation.

7. Timely place all equipment too large to fit through finished openings, stairways, etc.

C. Site Obstructions

1. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed; however, as to the accuracy of location or the completeness of the information.

2. Before any cutting or trenching operations are begun, verify with Architect/Engineer, utility companies, municipalities, and other interested parties that all available information has been provided. Verify locations given.

3. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the

new work and leave existing services and structures in a satisfactory and serviceable condition.

4. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown. If damaged, repair the lines at no additional compensation.

D. Cutting and Patching

1. Submit a written request to the Architect/Engineer in advance of cutting or alterations.

2. Execute cutting and demolition by methods which will prevent damages to other work and will provide proper surfaces to receive installation of repairs.

3. Restore work which has been cut or removed; install new products complying with specified products, functions, tolerances and finishes as stated in the contract documents.

4. Fit work airtight to conduit, sleeves and other penetrations through surfaces.

1.11 MATERIALS AND WORKMANSHIP

A. Provide new materials and equipment by those regularly engaged in the production and manufacture of specified materials and equipment. Where Underwriter's Laboratories or other agency has established standards for materials, provide materials which are listed and labeled accordingly. The commercially standard items of equipment and the specific names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

B. Perform work by workmen skilled in the trade required for the work. Install all materials and equipment to present a neat appearance when completed, in accordance with the approved recommendations of the manufacturer and the best practices of the trade and in conformance with the Contract Documents.

C. Provide all labor, materials, apparatus, and appliances essential to the complete functioning of the systems described or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Documents or not.

D. In cases of doubt as to the Work intended or in the event of need for explanation thereof, make written request for supplementary instructions to the Architect/Engineer.

E. Since manufacturing methods vary, reasonable minor variations are expected; however, performance and material requirements are the minimum standards acceptable. The right to judge the quality of equipment that deviates from the Contract Documents remains solely with the Architect/Engineer. Refer to Division 26 - Submittals.

1.12 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Follow the manufacturer's directions completely in the delivery, storage, and handling of equipment and materials.

B. Store equipment in a clean, dry place, protected from other construction. While stored, maintain factory wrappings or tightly cover and protect equipment against dirt, water, construction debris, chemical, physical or weather damage, traffic and theft. Evidence of damage from water or other contaminants will be cause for rejection.

C. Adequately brace and package equipment to prevent breakage and distortion while in transit.

1.13 PAINTING

A. Properly prepare all surfaces to receive paint. Prime prepared surfaces and finish with two (2) coats of exterior oil base paint.

B. Verify primer and paint are rated for application.

C. Repair any damage to factory painted finishes.

D. Remove splattered and incidental paint from all electrical equipment.

1. 14 NOISE AND VIBRATION

A. Provide the entire operating system and its component items of equipment free of objectionable vibration or noises. Statically and dynamically balance all rotating equipment, and mount or fasten so that no equipment vibration will be transmitted to the building. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, ballasts or other parts of the work, rectify such condition at no additional compensation.

1. 15 OPERATING INSTRUCTIONS

A. Provide the services of competent representatives of the manufacturer capable of certifying that the equipment is installed according to the manufacturer's recommendations, is operating properly, and to instruct Owner’s operating personnel during start-up and operating tests of the complete electrical system. Prove the operation of equipment to the satisfaction of the Architect/Engineer. Give at least seven days' notice to the Architect/Engineer prior to beginning equipment start-up.

B. Certify that these services have been performed by including a properly executed invoice for these services or a letter from the manufacturer.

C. Perform all tests outlined in Division 26 - Testing.

1. 16 SERVICE

A. Immediately prior to final acceptance of project, inspect, clean and service all light fixtures.

B. Clean and polish all fixtures, equipment, and materials thoroughly, and return to "as new" condition.

C. Remove all excess material and debris. Place all electrical systems in complete working order before request for final review. Broom-clean all areas.

1. 17 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Division 01

1. 18 FINAL REVIEW

A. Obtain all necessary Certificates of Occupancy from local authorities.

B. Prior to requesting final payment, submit final approved operation and maintenance manuals including approved submittals, test reports and "AS-BUILT" drawings. Delivery of operation and maintenance manuals is a condition of final acceptance. Refer to Division 26 - Operation and Maintenance Manuals.

1. 19 GUARANTEE

A. Guarantee materials, parts and labor for all work for one year from the date of issuance of occupancy permit. During that period make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship with no additional compensation and to the complete satisfaction of the Architect/ Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Equipment and materials furnished shall be listed by UL or other nationally accredited testing laboratory where available. When listing is not available for a piece of equipment, it shall be submitted in accordance with Drawings and Specifications and shall be approved by the authorities having jurisdiction.

B. Specifications and Drawings indicate name, type and/or catalog number of materials and equipment to establish standards of quality. Submittals shall be based on the standards specified. The standards should not be construed as limiting competition.

C. If materials and equipment other than specified herein are intended to be submitted, a letter providing a list of all the suggested alternates by section number, brand and series or model shall be submitted to the Architect for review and approval. Submit in accordance with Division 01 and a minimum of 14 days prior to submission of bids.

PART 3 - EXECUTION

3.1 COORDINATION

A. Install equipment in accordance with manufacturer's recommendations. Where conflicts occur between Contract Documents and these recommendations, request a ruling before proceeding with such Work.

B. Visit site and observe conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work required by these documents.

C. Examine Specifications and Drawings to be familiar with items which require electrical connections and coordination. Electrical Drawings are diagrammatic and shall not be scaled for exact sizes.

D. Prior to commencement of installation, prepare coordination drawings for work under this division, as specified in Division 01 and as called for herein. Coordinate work under other divisions, including but not limited to mechanical, plumbing, fire protection, telecommunication and miscellaneous steel to develop these coordination drawings that will serve as the agreed upon plan for a coordinated installation of work for all trades. Include electrical equipment, switchgear, panelboards, starters, disconnect switches, cable tray, conduit racks and conduits 3" and larger on drawings confirming coordination with other trades. Incorporate

the information onto the coordination drawings required under Division 01 and 23 to develop master coordination drawings. Account for lighting fixture depths in the coordination. Inform Design Professional of conflicts that cannot be resolved.

E. Do not submit coordination drawings to Architect for review. Keep a copy on site for reference purposes. Notify Architect of conflicts that cannot be resolved.

3.2 FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for electrical installation.

3.3 TEMPORARY LIGHTS AND POWER

A. Comply with provisions of Division 01.Provide a temporary electrical lighting and power distribution system of adequate size to properly serve the following requirements, including adequate feeder sizes to prevent excessive voltage drop. Temporary Work shall be installed in a neat and safe manner in accordance with the National Electrical Code, Article 305, NFPA 241, and as required by OSHA or applicable local safety codes.

B. Provide a minimum of one GFCI-protected duplex power outlet. Power outlets shall be GFCI-protected duplex 20 amp, 120 volt.

C. Provide feeders, disconnects, connections, etc., required for construction equipment, eg: cranes, pumps, etc.

D. Provide service and panelboards required for above lighting and power outlets.

E. Requirement for payment of utility bills during construction is specified in Division 01.

F. Provide single phase and three phase service as required by Project.

G. Remove temporary wiring upon completion of use.

3.4 DEMOLITION

A. Visit the site to observe existing conditions before submitting a bid.

B. Work shall be scheduled well in advance with the Owner's Representative. Work shall be performed at such times and under such conditions as suit the convenience of the Owner's Representative. Plan the Work to minimize disruption of normal operations. Notify Owner's Representative before any circuit is de-energized in occupied areas.

C. Reconnect circuits to other panelboards when required to complete the renovation shown.

D. Remove abandoned wire and conduit back to source. Splice and terminate in junction boxes as appropriate. Where entire circuit is to be removed, remove conduit and wire back to existing panelboard. Where such work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the work.

E. Where a circuit is interrupted by removal of a device or fixture from that circuit, install wire and conduit as required to restore service to the remaining devices and fixtures on that circuit. Ensure proper grounding is maintained.

F. Lighting fixtures, wiring devices, panelboards, equipment, conduits and conductors removed shall be transported to the Owner's designated location and offered to the OWNER. If he chooses to retain these items or a part of these items, turn those chosen over to him. Items rejected by the OWNER shall be removed completely from the project site and disposed of legally by the CONTRACTOR.

3.5 CUTTING AND PATCHING

A. Comply with provisions of Division 01

B. Repair or replace routine damage caused by cutting in performance of Work under this Division.

C. Correct unnecessary damage caused due to installation of electrical Work, brought about through carelessness or lack of coordination.

D. Repairs shall be performed with materials which match existing materials and be installed in accordance with appropriate sections of these Specifications.

E. Contractor shall not be permitted to cut or modify any structural members without the written permission of the Architect.

3.6 UTILITY COMPANY COORDINATION

A. Coordinate with the serving utility company as to all types of work required to be done by the contractor for utility equipment.

B. Confirm exact location of point of common coupling, duct banks, pads, etc.

C. Obtain copies of all pertinent utility company specifications relating to duct banks, concrete pads, raceways, and cable that are contractor installed for the utility company use. Maintain copies at project site.

D. Install at components in compliance with utility company specifications and project specifications.

3.7 TESTING ELECTRICAL SYSTEMS

A. On completion of work, installation shall be completely operational and entirely free from grounds, short circuits, and open circuits. Perform operational tests as required to demonstrate substantial completion of the Work. Balance circuits so that feeders to panels are not more than 10% out of balance between phases with all available load energized and operating. Furnish all labor, materials and instruments for above tests. All ampere readings shall be made with a true RMS reading meter.

B. Perform megger tests of all new or modified service entrance circuits, feeder and branch circuits size #4 AWG and larger. Provide a report of all such megger test results.

C. Furnish the Architect a copy of test reports and required certification including but not limited to the following for all new or modified:

1. Service ground resistance test

2. Switchboard and panelboard load test - include ampere readings of all panels and major circuit breakers

3. Ground Fault Test

4. Megger test results

D. Prior to final observation and acceptance test, install all electrical systems and equipment complete and in satisfactory operating condition.

END OF SECTION

SECTION 26 00 11

SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Documents, General Requirements for Building Construction and Related Work, apply to work specified in this section.

1.2 SCOPE

A. This section provides for the preparation and submission of shop drawings and product data.

B. Each section of Division 26 - Electrical that has products listed herein incorporates this section by reference and is incomplete without the provisions stated herein.

1.3 MANUFACTURERS

A. The listed manufacturers will be acceptable as long as they comply with the specifications.

B. Manufacturers who are not listed as "acceptable manufacturers" bear the burden of proof to the Engineer that their products comply with the specifications.

C. Provide all power distribution and control equipment of the same manufacturer (i.e., switchboards, panelboards, transformers, disconnect switches, etc.)

D. Provide all similar equipment of the same manufacturer (i.e., wiring devices, etc.).

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

A. Furnish product data for all of the devices, equipment or systems listed herein. All other submittals will be returned to the Contractor without review. Furnish shop drawings as indicated.

B. Electrical Identification.

C. Disconnect Switches

1. Furnish dimensions and ratings for voltage, ampacity, horsepower and short circuit.
2. Indicate enclosure material finish and NEMA classification type.

D. Panelboards

1. Include outline and support point dimensions, NEMA enclosure type, voltage, main bus ampacity and material, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

E. Transformers

1. Include dimensions, vibration isolation mounting detail, KVA and voltage of primary and secondary windings and energy efficiency rating.

F. Lighting Fixtures

1. Include product data for fixtures, including photometric data, reflectance, lens, lamps and ballasts.
2. Furnish samples upon request.

G. Lighting Relay Control Panels

H. Surge Protective Devices

3.2 FINAL SUBMITTAL

A. In addition to the number of copies of shop drawings and product data required to review submittals, maintain a separate file of final reviewed copies of such material. Deliver approved submittals in a hard-back binder for Owner's use. Incorporate changes and revisions made throughout the construction period. Refer to Division 26 - Operation and Maintenance Manuals.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide factory-wrapped waterproof flexible barrier material for covering wire and cable wood reels, where applicable, and weather resistant fiberboard containers for factory packaging of cable, wire and connectors, to protect against physical damage in transit. Damaged cable, wire or connectors shall be removed from project site.

B. In their factory-furnished packaging, store cable, wire and connectors in a clean, dry indoor space, to provide protection against the weather.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wire and Cable

1. Southwire.
2. Republic Wire
3. Allied Wire and Cable.
4. Triangle PWC, Inc.
5. Okonite
6. General Cable
7. AFC Cable Systems.

B. Connectors

1. T & B.
2. Burndy.
3. 3M.

C. Power Distribution Blocks

1. Square D.
2. Ilsco.

2.2 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2

C. Minimum conductor size shall be:

a. #12 AWG for power wiring

b. #14 AWG for controls unless otherwise specified

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. Connect and splice wire #8 AWG and smaller with self-insulating, wire nut connectors.

C. Terminate and splice all #6 AWG and larger copper conductors, except for load side lugs on Class I and II switchboards, panelboards, motor control centers, fusible switches, circuit breakers, transformers and individual motor controllers with high conductivity, wrought copper, color-keyed compression connector similar to T & B Series 54100 for terminal connection; Series 54500 for two-way copper-to-copper splices; and Series 54700 for tapping and pig-tailing copper conductors.

D. Motor Connections: 3M Series 5300-5304 or equal.

E. Where three (3) or more conductors larger than #8 AWG are installed in wiring gutter, utilize a screw-type power distribution block. Utilize split-bolt mechanical connector, filled and taped for smooth joint, only where specifically requested by Contractor and approved by Engineer

2.4 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 1/0 AWG; copper or aluminum for feeders No. 1/0 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Armored cable may not be used for this project.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables. Provide pull boxes in branch circuits or feeders over 100 feet in length.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Use #10 AWG conductor minimum for 20 ampere, 120 volt branch circuits longer than 100 feet, and for 20 ampere, 277 volt branch circuits longer than 200 feet.

G. Provide homerun conductors of continuous length without joint or splice from overcurrent device to first outlet. Where splices or taps are necessary, they shall be made in splice boxes.

H. Provide main service and feeder conductors of continuous length without joint or splice for their entire length.

I. Install all wiring in conduit, unless indicated otherwise.

J. Neatly train and lace wiring inside boxes, panelboards, switchgear, motor control centers, wiring gutters, and other equipment using "Ty-Wraps."

K. Provide equal conductor lengths for all parallel circuits.

L. A common neutral may not be used. Provide a separate neutral conductor for each circuit, unless indicated otherwise.

M. Remove and discard conductors cut too short or installed in wrong raceway. Do not install conductors which have been removed from a raceway.

N. Do not install conductors in conduit which contains wires already in place.

O. Color code conductors as follows:

1. 120/208 Volt Systems:
   a. Phase A – Black
   b. Phase B – Red
   c. Phase C – Blue
   d. Neutral – White
   e. Ground – Green
   f. Isolated Ground – Green with Yellow Strip

2. 277/480 Volt Systems:
   a. Phase A – Brown
   b. Phase B – Purple
   c. Phase C – Yellow
   d. Neutral – Gray
   e. Ground – Green

P. Use factory color coded conductors where commercially available. If not available, use black conductors and band with color tape.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. Make feeder splices and taps with approved compression sleeves. Insulate sleeves with heat shrink tubing, rated 600V, 90 degree C, containing factory applied sealant.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Electrical Identification."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Check for proper torque of all mechanical connections. Certify compliance with test parameters.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Grounding for sensitive electronic equipment.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells based on NETA MTS.

    a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
    b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install two parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Flexible raceway runs.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
   1. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Metal Structures Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

   1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install [**tinned**]bonding jumper to bond across flexible duct connections to achieve continuity.

3.5 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**,** at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in

alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Atkore International.
    g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; galvanized.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Existing Concrete: Expansion anchor fasteners.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 6 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Rigid Metal Conduit, Intermediate Metal Conduit, Electrical Metallic Tubing and Fittings

1. Allied Tube and Conduit Corporation.
2. Wheatland Tube Co.
3. Republic Conduit.
4. Western Tube and Conduit.

B. Flexible Conduit and Fittings

1. Electri-Flex Co.
2. Anamet, Inc.
3. Triangle PWC, Inc.

C. Nonmetallic Conduit and Fittings

1. Carlon.
2. Can-Tex Industries.
3. Certain-Teed.

2.2 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

E. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

F. Gangable boxes are allowed.

G. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: Type EPC-40-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Minimum size of homerun and feeder conduits is 1 inch. Indicated sizes are minimum based on THHN/THWN copper wire and larger sizes may be used for convenience of wire pulling.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

C. Arrange stub-ups so curved portions of bends are not visible above finished slab.

D. Install no more than the equivalent of four 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

E. Support conduit within 36 inches of enclosures to which attached.

F. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

G. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

H. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and high impact phenolic bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

J. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

K. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires**,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

L. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

M. Fasten junction and pull boxes to or support from structure. Do not support boxes by conduits.

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

D. Color code equipment identification to identify electrical equipment according to which branch of the electrical system the equipment is connected as follows:

1. Normal – Black with white letters

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Normal – Black with white letters

C. Install instructional sign including color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

F. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Panelboard schedules for installation in panelboards.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus Configured Terminators: Mechanical type.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.;
2. General Electric Company;
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Door within door enclosure: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.;

2. General Electric Company;
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 84 inches above finished grade unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Electrical Identification."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 “Electrical Identification."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Electrical Identification."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Switches and Receptacles:

1. Pass & Seymour/Legrand;
2. Hubbell Incorporated;
3. Cooper Wiring Devices;
4. Leviton Mfg. Company Inc.

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Damp Locations: Thermoplastic, listed and labeled for use in wet and damp locations.

E. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, in-use weather-resistant thermoplastic with lockable cover.

2.3 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. A single receptacle installed on an individual branch circuit shall have an ampere rating of not less than the rating of the branch circuit.

C. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

D. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

E. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
3. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
6. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.

7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
B. Related Requirements:
   1. Section 262413 " Switchboards " for factory-installed SPDs.
   2. Section 262416 " Panelboards " for factory-installed SPDs.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.
B. MCOV: Maximum continuous operating voltage.
C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
E. OCPD: Overcurrent protective device.
F. SCCR: Short-circuit current rating.
G. SPD: Surge protective device.
H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.
B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB France.
2. Advanced Protection Technologies Inc. (APT).
3. Eaton Corporation.
4. Emerson Electric Co.
5. GE Zenith Controls.
6. LEA International; Protection Technology Group.
7. Leviton Manufacturing Co., Inc.
8. PowerLogics, Inc.
9. Schneider Electric Industries SAS.
10. Siemens Industry, Inc.

2.2 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.
C. Comply with UL 1449.
D. MCOV of the SPD shall be at least 125 percent of the nominal system voltage.
E. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear and switchboard assemblies. All SPD shall be tested and demonstrated suitability for application within ANSI/IEEE C62.41 Category A, B and C environments.

1. Category A shall be used for lighting panelboards, major medical equipment and busways.
2. Category B shall be used for distribution panelboards, emergency system panelboards and medical equipment panelboards.
3. Category C shall be used for service entrance, switchgear, switchboards and motor control centers (MCC).

2.3 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 1.

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status
e. Surge counter.

B. Comply with UL 1283.
C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA.. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
D. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 1000 V.
3. Line to Line: 1000 V.

E. SCCR: Equal or exceed 100 kA.

F. Inominal Rating: 20 kA.

2.4 ENCLOSURES

A. Outdoor Enclosures: NEMA 250, Type 4

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.
B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
D. Use crimped connectors and splices only. Wire nuts are unacceptable.
E. Wiring:

    1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
    2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.
B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.
C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when install in compliance with manufacturer’s written instructions and any applicable national or local code.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles exceeding 49.2 feet in height is 100 mph.

   a. Wind Importance Factor: 1.0
   b. Minimum Design Life: 50 years.
   c. Velocity Conversion Factors: 1.0.

2. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

   a. Wind Importance Factor: 1.0.
   b. Minimum Design Life: 25 years.
   c. Velocity Conversion Factors: 1.0.

1.3 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools.

Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
   a. Color: Medium bronze

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. 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.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: Medium bronze

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USES ONLY" and include specific lamp type.
    b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
    c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
    d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
    e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay.[**Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.**]

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

2.5 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.
2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

D. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

E. Raise and set poles using web fabric slings (not chain or cable).

3.3 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing above- and below-grade site improvements.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Temporary erosion and sedimentation control.

1.2 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.5 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited. All ashes and debris from burning shall be removed and disposed of offsite. Burying ashes is not allowable.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
3. Subbase course for concrete pavements.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Controlled low-strength material, including design mixture.
2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Warning Tape: 12 inches (300 mm) long; of each color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each [on-site] [and] [borrow] soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify utility locator service call 811 for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control.

E. Do not commence earth-moving operations until plant-protection measures as indicated on plans are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a

combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: Refer Geotechnical Report
2. Plasticity Index: Refer Geotechnical Report

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940 with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940 with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Sand: ASTM C 33/C 33M; fine aggregate.

H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.

4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit

prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Roadways: Provide 6-inch- thick, cement stabilized sand support for piping or conduit less than below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 6 inches of cement stabilized sand before backfilling or placing roadway subbase course.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material or satisfactory soil], free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

G. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction t indicated of optimum moisture content, within tolerance.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course[and base course] under pavements and walks as follows:
1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase[and base] layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 32 01 90

LANDSCAPE MAINTENANCE

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials and equipment necessary to provide the complete landscape maintenance program as specified herein and in accordance with the drawings and specifications for the trees, shrubs, groundcovers installed as part of this Contract.

B. Work shall include, but not necessarily limited to:

1. Monitoring and coordination for adjustment of automated irrigation system including adjustment of irrigation clocks.
2. Dewatering of trees.
3. Pruning and trimming of trees, shrubs, and groundcovers
4. Application of fertilizers, soil amendments, insecticides, and herbicides.
5. General site clean up to include removal of trash and products of maintenance on sidewalks, pavement curbs, and other hardscape areas.
6. Mowing, edging and trimming of lawn areas(if applicable)
7. Weeding, cultivating, and cleaning of all planting areas.
8. Mulch top dressing.
9. Deep watering of trees, shrubs, and or ground covers in addition to irrigation system.

1.2 RELATED WORK IN OTHER SECTIONS

A. The Contractor shall examine all related Sections for work related to this section.

1.3 CONTRACT PERIOD AND STANDARDS

A. Contractor shall begin maintenance immediately upon starting any portion of the Work of this Contract.

B. The maintenance period shall continue for ninety (90) days after the issuance of a certificate of Substantial Completion.

1. Maintenance includes work on completed and partially completed project areas.
2. Maintenance shall provide a project site that is neat and attractive in appearance, and keeps all plant materials and lawns in a healthy and vigorous condition.

C. The Contractor's presence on the site shall be as inconspicuous as possible.
1. Personnel employed by the Contractor for maintenance and repairs shall be neatly attired with long pants and shirts at all times.

D. Turf, shrubs, trees or plants that are damaged or killed due to Contractor's operations, negligence, or chemical treatments shall be replaced at no expense to the Owner.

E. Sprinklers or structures that are damaged due to the Contractor's operation must be replaced by the Contractor promptly.

F. Damage due to thefts or vandalism prior to the date of the certificate of Substantial Completion shall be at the Contractor's expense.

G. All damage to, or thefts of landscape elements not caused or allowed by the Contractor after the issuance of the certificate of Substantial Completion shall be corrected by the Contractor at the Owner's expense, upon receipt of written authorization to proceed.

H. The Contractor shall answer emergency or complaint calls regarding conditions in landscaped areas regarding fallen trees or branches, or shrubs or trees that obstruct the driveways, and shall correct the problem or place warning signs and advise the Owner of the need for major work to be performed.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Perform Work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction of such work and provide for all permits required by local authorities..

B. The maintenance period shall continue for ninety (90) days after the issuance of a certificate

1.5 FINAL ACCEPTANCE

A. Work under this section will be accepted by the Owner upon satisfactory completion of all work, including maintenance, but exclusive of the required replacement of trees, shrubs, and/or groundcovers under the Warranty Period. Upon Final Acceptance, Owner will assume responsibility for coordination the maintenance of the Work.

1.6 WARRANTIES AND GUARANTEES

A. Refer to the other appropriate Sections.

1.7 MAINTENANCE INSTRUCTIONS

A. At the completion of Work, furnish three (3) copies of written maintenance instructions to the Owner for maintenance and care of the trees, shrubs, and groundcovers throughout the year.

B. Contractor shall provide to Owner a Spring, Summer, Fall, and Winter propose irrigation schedule based upon the typical weather conditions at the job site for the specific season. The Contractor shall adjust watering cycles to reflect typical, seasonal evaportranspiration rates.

1.8 MEASUREMENT AND PAYMENT

A. Stipulated Price(Lump Sum): If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials required for installed items shall match those already in use.

B. Samples of all materials not specified under other sections of the Specifications shall be submitted to the Landscape Architect or Owner's Representative for review by the Owner prior to use.

C. Top Dress Fertilizer: See other related Sections on Turf and Planting.

2.2 MACHINERY

A. Lawn Mowers: Rotary-type

B. Lawn Edgers: Rigid or flexible blade-type, gasoline powered.

C. Lawn Blowers: Rigid or flexible blade-type

D. Fertilizer Spreaders: Cyclone-type spreader, or equal.

E. Pruning Tools: Cutting edges shall be sharp. Disinfect all tools when used for the removal of diseased limbs with Clorox and water, mixed at a 1:5 ratio.

F. Miscellaneous Hand Tools, Rakes, Brooms, Etc.

PART 3 EXECUTION

3.1 MAINTENANCE OF TREES, SHRUBS, AND GROUND COVERS

A. All weeds within the mulched planting bed areas shall be removed as often as required. Under no circumstance shall weeds within planting bed areas be allowed to attain a height greater than three (3) inches.

B. Contractor shall continuously be alert for signs of insect and/or plant disease presence or damage, especially plant fungi other diseases which would affect the long term health of the plant material. Upon locating such evidence, the Contractor shall report it to the Owner and take action as directed.

C. Prune and trim palm fronds, trees, shrubs, and groundcovers as required to obtain and maintain the specimen growth habit.

D. Maintenance shall be performed by the Contractor's own force, superintended by personnel familiar with the job.

E. Accidental damage to the landscape plantings beyond the control of the Contractor shall be reported immediately to the Owner.

F. Contractor shall adjust and tighten all tree staking and guying as required.

3.2 MAINTENANCE OF IRRIGATION SYSTEM

A. The Contractor shall monitor and adjust the irrigation controllers to maintain optimum moisture levels in all planted areas.

B. Regular deep watering to all new trees until there are definite signs that the trees have established themselves, new growth is apparent, and no trees are experiencing stress conditions.

C. Contractor shall adjust the heads for coverage and elevation, repair any leaks to main, lateral, or drip lines and all other work required to establish a complete working irrigation system.

B. Regular irrigation cycles shall be set to take place after 11:00 pm and prior to sunrise (4:00 am - 5:00 am), except during visits of grounds maintenance personnel at which the irrigation system may be operated as desired by those personnel for maintenance purposes.

3.3 TREE STAKING

A. Contractor shall maintain staking of trees at all times, and shall be responsible for any damage to trees or plant materials caused by chafing or breaking of foliage or limbs coming in contact with stakes, ties, guys, eye bolts, or bracing materials. Periodically, adjust broken stakes and ties as needed. If ties are too tight, they must be replaced or adjusted.

1. All labor and material costs shall be considered in base bid for the ninety (90) day maintenance period.

B. Tees and large shrubs that may require stakes or special care during the winds and rains shall receive the required care prior to and immediately after anticipated and actual occurrences, to insure that no damage results to the plant material.

3.4 PRUNING

A. Contractor shall prune regularly, as required. Remove dead wood and aesthetically horticulturaly balance the planting.

3.5 TURF MAINTENANCE

A. Mowing:

1. Cool weather, mow at one and one-half inches (1 1/2")
2. Hot weather not lower than two inches (2") from the soil.
3. Weekly mowing is recommended. Promptly remove excessive clippings.

B. Watering:

1. Provide a regular, deep watering program for all turf zones. The established turf should be allowed to dry out under regular conditions.
2. Provide a regular, deep watering program for all trees. Water as necessary to maintain trees in thriving condition.

C. In areas of new planting and lawns, allow new lawn to grow over tree ball. Maintain height of grass at tree trunk with hand clippers. Do not use weed whips around tree trunks.

D. top dress fertilize 60 to 90 days after seeding or sodding, but prior to end of the 90 day maintenance period.

3.6 WATERING

A. It shall be the responsibility of the Contractor to assure that the correct watering of trees, shrubs, and ground covers is being accomplished through the irrigation system.

B. Contractor shall be responsible for damages to the irrigation system caused by maintenance operations under this section.

C. Contractor shall water as often and to the amount necessary to establish the trees, shrubs, and ground covers.

3.7 DE-WATERING

A. Contractor shall inspect the tree well inspection tubes weekly or as needed for the specific site conditions.

B. The Contractor shall de-water by pumping or siphoning as often as necessary to remove excess moisture from the tree inspection tubes

C. When observed, the Contractor shall report this condition immediately to the Owners Representative.

3.8 MULCHING

A. Tree Rings:

1. Ongoing maintenance of the mulch rings are critical. Contractor shall take care to not disturb the mulch rings around trees and repair as necessary.
2. Scheduled mulching shall occur as noted in the proposed schedule below
3. The Contractor shall be responsible for the additional mulching as necessary to maintain the mulch rings in addition to the regularly scheduled times.
4. The mulch rings shall be maintained at a minimum mulch depth of 3”

B. Shrubs beds:

1. Scheduled mulching shall occur as noted in the proposed schedule below
2. Mulch areas shall be maintained at a minimum mulch depth of 3”.

3.9 TRASH COLLECTION AND GENERALCLEAN UP

A. The Contractor shall dispose of all waste materials or refuse from his operations off the property.

B. Keep all sidewalk expansion and score joints free of any vegetation which may appear.

C. Leaves, litter, grass clippings or other debris shall be removed from all areas at each visit

D. Remove dead animals from the site immediately, as they are encountered.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Driveways.
2. Parking lots.
3. Curbs and gutters.
4. Walks.

B. Related Requirements:

1. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
2. Section 321713 "Parking Bumpers."
3. Section 321723 "Pavement Markings."

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

B. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.6 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray form, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60 deformed.

B. Joint Dowel Bars: ASTM A 615, Grade 60 pain-steel bars. Cut bars true to length with ends square and free of burrs.

C. Tie Bars: ASTM A 615, Grade 60, deformed.

D. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

F. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.4 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150,portland cement Type I or Type III.
2. Fly Ash: ASTM C 618, Class C or Class F.

C. Normal-Weight Aggregates: ASTM C 33, 1 ½" to No. 4 Sieve, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: Potable and complying with ASTM C 94.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Retarder shall be certified to be compatible with concrete marking paint.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Retarder shall be certified to be compatible with concrete marking paint.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

1. Retarder shall be certified to be compatible with concrete marking paint.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials:

1. Fly Ash: 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 3-1/2 percent plus or minus 1 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 3-1/2 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture high-range, water-reducing admixture high-range, water-reducing and retarding admixture or plasticizing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 3500 psi
2. Maximum W/C Ratio at Point of Placement: 0.45
3. Slump Limit: 5 inches plus or minus 1inch.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd. increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 60 feet unless otherwise indicated on drawings.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during

finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch
2. Thickness: Plus 3/8 inch minus 1/4 inch
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch
6. Vertical Alignment of Dowels: 1/4 inch
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches
9. Contraction Joint Depth: Plus 1/4 inch , no minus.
10. Joint Width: Plus 1/8 inch , no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 2000 sq. ft. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.11 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.
3. Primers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer [or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:

   a. Expansion and isolation joints in concrete paving.
   b. Contraction joints in concrete paving.
   c. Other joints as indicated.

2. Joint Sealant: Single-component, self-leveling, silicone joint sealant.
3. Joint-Sealant Color: Manufacturer's standard.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1. Joint Location:

   a. Joints between concrete and asphalt paving.
   b. Joints between concrete curbs and asphalt paving.
   c. Other joints as indicated.

2. Joint Sealant: Hot-applied, single-component joint sealant.
3. Joint-Sealant Color: Manufacturer's standard.

END OF SECTION

SECTION 32 17 13

PARKING BUMPERS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wheel stops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For wheel stops, 6 inches showing color and cross section; with fasteners.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches. Provide chamfered corners, transverse drainage slots on underside, and a minimum of [three] factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
2. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 10-inch minimum length.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

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

3.2 INSTALLATION

A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring.

C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes painted markings applied to concrete pavement.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of City of Houston for pavement-marking work, within public rights of way.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type 1; colors complying with FS TT-P-1952.

1. Color: As indicated

B. Pavement-Marking Paint: MPI #32, alkyd traffic-marking paint.

1. Color: As indicated on plans.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than [three] [45] minutes.

1. Color: As indicated on plans

D. Pavement-Marking Paint: MPI #97, latex traffic-marking paint.

1. Color: As indicated.

E. Glass Beads: AASHTO M 247, Type 1

1. Roundness: Minimum 75 percent true spheres by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

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

END OF SECTION

SECTION 32 17 26

TACTILE WARNING SURFACING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.
2. Surface-applied detectable warning tiles.
3. Detectable warning mats.
4. Detectable warning unit pavers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

    a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Deterioration of finishes beyond normal weathering and wear.
    b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Color: As selected by Architect from manufacturer's full line.

2. Dome Spacing and Configuration: Manufactures Standard Pattern 2.35-inch.
3. Mounting:

a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.
b. Detectable warning tile set into formed recess in concrete and adhered with adhesive.
c. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

B. Surface-Applied Detectable Warning Tiles: Accessible truncated-dome detectable warning concrete tiles configured for surface application on existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of tile, and beveled outside edges.

1. Color: As selected by Architect from manufacturer's full line.

2. Dome Spacing and Configuration Manufacturer's standard compliant spacing in manufactures standard pattern.
3. Mounting: Adhered to existing concrete walkway.

2.3 DETECTABLE WARNING MATS

A. Surface-Applied Detectable Warning Mats: Accessible truncated-dome detectable warning resilient mats, UV resistant, manufactured for adhering to existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of mat, and beveled outside edges.

1. Material: Modified rubber compound, UV resistant.
2. Color: As selected by Architect from manufacturer's full range.

3. Dome Spacing and Configuration: Manufacturer's standard compliant spacing, in manufacturer's standard pattern.
4. Mounting: Adhered to pavement surface with adhesive.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish [Type 304] stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.

C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

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

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

B. Removable Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.
2. Set each detectable warning tile accurately and firmly in place with embedding anchors and fasteners attached, and firmly seat tile back in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.

4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

C. Surface-Applied Detectable Warning Tiles:

1. Lay out detectable warning tiles as indicated and mark concrete pavement.
2. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.

    a. Cut perimeter kerf in existing concrete pavement to receive metal tile flange.

3. Apply adhesive to back of tiles in amounts and pattern recommended by manufacturer, and set tiles in place. Firmly seat tiles in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
4. Install anchor devices through face of tiles and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with top surface of mat.
5. Mask perimeter of tiles and adjacent concrete, and apply sealant in continuous bead around perimeter of tile installation.
6. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning tiles and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
7. Protect installed tiles from traffic until adhesive has set.

3.4 INSTALLATION OF DETECTABLE WARNING MATS

A. Lay out detectable warning mats as indicated and mark concrete pavement at edges of mats.

B. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.

C. Apply adhesive to back of mat in amounts and pattern recommended by manufacturer, and set mat in place. Firmly seat mat in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to mat to ensure full contact with adhesive.

D. Install anchor devices through face of mat and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with mat surface.

E. Mask mat perimeter and adjacent concrete, and apply sealant in continuous bead around perimeter of mat.

F. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning mat and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.

G. Protect installed mat from traffic until adhesive has set.

3.5 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION

SECTION 32 80 00

IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work required under this Section consists of furnishing all labor materials, equipment, services and related items necessary to complete all irrigation system work, and all related work, complete as indicated on the drawings or specified herein.

B. The major items of work include, but are not limited to the following:
   1. Coverage indicated on Drawings and specified herein. Layout portions of irrigation system not indicated on Drawings to meet specified coverage in compliance with local codes and regulations.
   2. Complete irrigation system including trenching and backfilling for all pipes, valves and drain pits, providing mains, laterals, risers, fittings, sprinkler heads, valves, controllers, controller enclosures, backflow preventers, meters, electric wiring, and any and all necessary specialties and accessories.
   3. Sleeves and/or bores beneath parking areas, walkways, roads, and driveways where required.
   4. Regulate and adjust sprinkler heads, timed sequence control devices, sectional valves and rain over rider.
   6. Each zone to comprise of approximately equal water demand. Flow rates through pressure and non-pressure pipe not to exceed 5 feet per second.
   7. Sprinkler heads and/or bubblers in a zone shall have the same precipitation rate.
   8. Provide 100 percent coverage by locating heads as recommended by the manufacturer. Proper overlap shall prevent "scalloping". No throw is permitted over walks, drives or buildings.
   9. Turf and unlike plant materials shall be zoned separately based on water needs.
   10. Locate heads discretely using risers only in shrub beds.
   11. Heads adjacent to pavement shall be installed on swing joints.
   12. Consider all plant heights and grade changes in design and installation of the irrigation system.
   13. Providing, coordination, and installing electrical power source to irrigation controller.

C. Work items included in this section relate specifically to the installation of the drip irrigation portion of the irrigation system. Items include, but are not limited to the following:

D. Other major work items included in the Contract and related to this section , that are found in Section 328500 Drip Irrigation include, but are not limited to the following:

1. Dripper lines shall be located as recommended by manufacturer, or as specified herein, so as to provide an even and complete distribution of water throughout the planter bed.
2. Dripper lines shall be placed at the depth specified and shall not be visible on the surface.
3. Drippers in a zone shall have the same precipitation rate.
4. Regulate and adjust irrigation zones, timed sequence control devices, sectional valves and rain over rider.
5. Each zone to comprise of approximately equal water demand. Flow rates through pressure and non-pressure pipe shall not to exceed 5 feet per second.
6. Provide 100 percent coverage by locating dripper lines as recommended by the manufacturer and as indicated in the Drawings.
7. Turf and unlike plant materials shall be zoned separately based on water needs.
8. Consider all plant heights and grade changes in design and installation of the irrigation system.

E. The Contractor shall coordinate all activities with the installation of related electrical equipment and primary power wiring by the electrical subcontractor. The Owner shall be responsible for submitting for electrical service from the appropriate local utility service

F. The Contractor shall pay for any and all application, permit and installation costs for the proposed meter location(s), as shown on plans.

G. Coordinate connection of main line to water meters.

H. Irrigation system tests and inspections.

I. Record "as built" drawings.

J. Clean up and disposal.

K. Warranties.

1.2 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with specified requirements. Manufacturers. Firms regularly engaged in manufacturing irrigation systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms who have successfully completed execution of a minimum of five (5) contracts involving the installation of irrigation and piping work similar in size and scope to that required for this project. Such experience should be able to be demonstrated through references. Irrigation installation

shall be performed under the direction of a State of Texas Licensed Irrigator with not less than five (5) years experience in this type of work.

C. Approved Installers:
The landscape architect reserves the right to reject a landscape irrigation subcontractor if they do not the basic qualifications, terms, and conditions as outlined in the specifications that specify minimum experience and certifications. Or are deemed to not have enough experience with projects of a similar size and scope as is being bid.

D. A current set of construction drawings, including addendums, shall be on the construction site at all times while the irrigation system is being installed. Contractor shall make a daily record of all work installed during each day. Actual location of valves and quick couplers and all irrigation and drainage piping shall be shown on the prints by dimensions from easily identified permanent features, such as buildings, curbs, fences, walks or property lines.

E. Reference Standards Applicable to this Section:
1. ANSI: American National Standards Institute
   a. Z55.1: Gray Finishes for Industrial Apparatus and Equipment
2. ASTM: American Society for Testing and Materials
   a. B88: Specifications for Seamless Copper water tube.
   b. D 1785: Specifications for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   c. D 2241: Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
   d. D 2466: Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
   e. D 2564: Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
   f. F 690: Practice for Underground Installation of Thermoplastic Pressure Piping Irrigation Systems.
   g. ASTM B32 – Solder Metal
   h. ASTM B42 – Seamless Copper Pipe, standard sizes
   i. ASTM D2282 – Acroylonitrile-Butadience-Styrene (ABS) plastic pipe
   j. ASTM D2235 – Solvent Cement for ADS plastic pipe and fittings.
   k. NETA 250 – Enclosures for electrical equipment (if applicable)
3. AWWA: American Water Works Association
   a. C 500: Gate Valves, 3 inches through 48 inches NPS, for Water and Sewage Systems.
   b. C 506: Backflow Prevention Devices, Reduced Pressure Principle and Double Check Valve Types.
4. IAMPO: International Association of Plumbing Mechanical Officials: UBC: Uniform Building Code

5. NEMA: National Electrical Manufacturer's Assoc.: 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
6. NFPA: National Fire Protection Association: NFPA 70 (NEC): National Electric Code
7. UPC: Uniform Plumbing Code
8. NSF: National Sanitation Foundation: No. 14: Plastic Piping System Components and Related Materials
9. Regulatory Requirements:

    a. Conform to applicable *county, state and federal Plumbing* codes and regulations as well as The Regulations of Safety Orders of the Division of Industrial Safety, The Uniform Plumbing code and any other laws, codes, or regulations that may have jurisdiction over this work.
    b. Contractor shall in no circumstances proceed with work that is knowingly in conflict with any of the aforementioned codes, laws, or regulations and shall notify the Landscape Architect or Owner's Representative of any such discrepancies or conflicts before proceeding with work that may be affected.
    c. Arrange inspections required by local agencies and ordinances during the course of construction (if applicable.)

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, shop drawings, specifications, and installation instructions for irrigation system materials, including, but not limited to irrigation heads, pop-up bodies, risers, automatic and manual valves, controllers, backflow preventers, pipe and fittings, air relief valves, line flush valves, flow regulators, filters, irrigation boxes, details, and all other related items. and products. Contractor to submit three (3) copies of manufacturer’s catalog cuts for review and approval by the Landscape Architect or Owner’s Representative.

B. Record Drawings: At project close-out, submit record drawings of installed irrigation system piping and products, in accordance with requirements of Division 1.

C. Maintenance Data: Submit maintenance data and parts lists for irrigation system materials and products. Include these data, product data, shop drawings and record drawings in maintenance manual, in accordance with the specifications and drawings.

D. Water: Contractor shall make provisions for all connections required including taps and meters.

E. Project Closeout:
    1. Division 1 specifications

2. Record Drawings
   a). As Builts: Drawings of the completed irrigation system noting all approved field modifications.
   b). Landscape Architect or owner's representative will provide full- sized prints or reproducibles of the Contract Drawings for the contractor's use.
   c). The record set shall be turned over to the Landscape Architect or owner's representative at or before the Final Acceptance of the project.

1.4. REVIEWS AND TESTS

A. The Contractor shall provide access at all times for inspection of trenches and backfilling by the Landscape Architect or Owner's Representative during all phases of construction. At the request of Landscape Architect, if necessary, contractor shall uncover portions of line and wire during hydrostatic testing and final inspection.

B. The Contractor shall be responsible for making all repairs required to the irrigation system until the issuance of the Certificate of Substantial Completion. Upon the issuance of the Certificate, the Owner shall assume responsibility for the repair and maintenance of the irrigation system.

C. All required testing shall be performed at the expense of the contractor.

1.5 UTILITIES AND PROTECTION

A. Existing Utilities
   1. Contractor shall acquaint himself/herself with all site conditions. Should utilities not shown on the plans be found during excavations, contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage there to arising from his/her operations subsequent to discovery of such utilities not shown on plan.
   2. Contractor shall necessary adjustments in the Layout as may be required to connect the existing stub outs. Should such stubs not be located exactly as shown, Contractor may be required to work around existing conditions at no increase in cost to the Owner.

1.6 PRODUCT DELIVERY AND HANDLING

A. Materials shall be delivered in manufacturer's unopened packaging labeled to indicate manufacturer's name and product identification. Insure that packaging and labeling remain intact until installation. Materials shall be stored protected from the elements, including direct sunlight.

B. Pipes shall be handled so as to prevent being damaged and to maintain their straightness. Pipe ends shall be wrapped. Pipes shall be stored on beds the full length of the pipes. Damaged or dented pipes or fittings shall not be used.

1.7 DEFINITIONS

A. Irrigation Main: Irrigation main is the piping from the water source to control valves. Irrigation main is that pipe which is on the pressure side of irrigation control valves.

B. Irrigation Lateral Lines: Irrigation lateral line is the piping from the control valves to the irrigation heads. Lateral line is that pipe which is on the non-pressure side of irrigation control valves.

1.8 PERMITS AND FEES

A. Contractor shall procure and obtain all permits and pay required fees to any governmental agency having jurisdiction over the work. Inspections required by local ordinances during the course of construction shall be arranged as required. These shall include, but are not limited to, required fees for water meter taps, sub-meters, backflow devices, electrical hookups or any other products or installations requiring agency approval fees.

B. On completion of the work, satisfactory evidence shall be furnished to Owner to show that all work has been installed in accordance with the ordinances and code requirements.

C. Contractor shall pay all required fees for water meter taps, sub-meters, backflow devices, electrical hookups or any other products or installations requiring agency approval fees.

D. Contractor shall not be required to pay for capital recovery fees or other fees required by any governmental agency to provide the necessary utility.

1.9 DRAWINGS, SPECIFICATION AND DETAIL SHEETS

A. Scale and Dimensions

1. Consider drawings and specifications as being compatible and therefore work called for by one and not the other shall be furnished and installed as though called for by both. When discrepancies exist between scale and dimension or between the works to be accomplished by each trade, they shall be called to the Landscape Architect's attention immediately. The Landscape Architect's or Owner's Representative decision regarding such discrepancies shall be final and binding.
2. Where diagrams have been made to show piping connections, etc., Contractor is cautioned that these diagrams must not be used for obtaining liner runs or number and type of fittings.
3. All measurements shall be verified at the site. Drawings may not be exactly to scale.
4. Unless otherwise specified within sleeves a/or bores all irrigation equipment shall be placed in landscape areas.

1.10 SUBSTITUTIONS

Contractor shall not substitute any irrigation equipment without approval of the Landscape Architect as indicated in Division 1 Specifications

1.11 WARRANTY

A. Warranty all work done for one year from date of acceptance against all defects in material, equipment and workmanship. Guarantee shall cover repair of damage to any part of the premises resulting from leaks, or other defects in material, equipment and workmanship to the satisfaction of the Owner. Repairs, if required, shall be done promptly, at no cost to the Owner.

B. Warranty will include spring start-up and winterizing of system within the one (1) year time and development of approved water application schedule. Winter damage due to improper winterization is the responsibility of the Contractor.

C. All repairs and servicing required under the guarantee period shall be made under the observation of the maintenance crew to help train them in the proper operation, and repair of the system.

1.12 PRE-CONSTRUCTION MEETING

A. Division 1 Specifications

B. Irrigation contractor shall attend the scheduled pre-construction meeting that will convene at least one week prior to starting work of this section

1.13 EXTRA MATERIALS

A. Division 1 Specifications

B. Provide:

1. Two spray bodies of each type and size
2. Two rotor bodies of each type and size
3. Two remote control valve cover keys of each type and size
4. Two quick coupler keys
5. Two quick coupler valve cover keys
6 One extra manual valve key for backflow preventer.
7. Controller manuals and/or instructions.

1.14 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum): If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials and equipment to be installed new and free from defects or damage. No previously used products shall be used.

B. The Contractor shall submit a complete list of materials, including proposed substitutes, to the Landscape Architect or Owner's Representative for approval, prior to the start of construction.

C. Equipment shall include, but is not limited to
1. Irrigation heads, valves, controllers, backflow preventers, pressure mainlines and non-pressure lateral lines:, fittings, control wiring, decoders, surge protectors, grounding rods, controllers, meters, points of connection, and any and all miscellaneous equipment.
2. Provide piping materials and factory, fabricated piping products of sizes, types, pressure ratings and capacities as indicated. Where not indicated, provide proper selection as determine by Installer to comply with installation requirements.
3. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (NSF) approval.

2.2 IRRIGATION PIPING AND FITTING MATERIALS

A. Piping:
Provide pipes of one of the following materials of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
1. Polyvinyl Chloride (PVC): Sized as shown on the drawings. All PVC pipe shall be continuously and permanently marked with manufacturer's name, material and schedule or type. Pipe shall conform to U.S. Department of Commerce Commercial Standard CS 256-63, or latest revision. PVC pipe schedules as indicated.
2. Fittings: PVC 1120, Schedule 80, polyvinyl chloride (PVC) weight as manufactured by Spears or approved equal. Solvent weld as described below. No saddle type clamping or fittings shall be used. Fittings to conform to ASTM D-2467.

B. Piping, Fittings and Connections:
1. Solvent weld pipe - manufactured from virgin polyvinyl chloride (PVC) compound in accordance with the following grades and standards.
   a). Main all sizes: ASTM D 2231, PVC 1120, SCH-40, 200 PSI(class 200)
   b). Laterals 1/2" Diameter: ASTM D 2241, PVC 1120, SDR 13.5, 315 PSI(class 315)
   c). Laterals 3/4" Diameter and larger: ASTM D 2231, PVC 1120, SDR 21, 200 PSI(class 200)

d) Fittings - Standard weight, Schedule 80, injection molded PVC, complying with ASTM D1784 and D2466, cell classification 12454-B.
1) Threads - injection molded type (where required).
1) Tees and ells - side gated.

e) Threaded nipples - ASTM D2464, Schedule 80 with molded threads.

f) Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings.

2. Gasketed End Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM 1784; cell classification 1254-B, Type 1, Grade 1, Size: 3" and larger.
Mains and laterals: SDR-21, 200 psi(class 200)
a). Fittings 3" and above - Series 200, injection molded PVC, complying with ASTM D1598, D1599, D3139, F610.
b). Gaskets - Factory or Distributor installed in pipe and fittings, having a metal or plastic support within gasket or plastic retainer ring for gasket.
c). Lubricant - As recommended by manufacturer of pipe fittings.

3. Fittings for Sprinkler and Quick Coupler Swing Joints:
a). PVC Schedule 80 "Marlex" street elbows
b) Threaded PVC Nipples shall be Schedule 80 PVC.
c). Lengths of PVC nipples as shown on plans
d). PVC Schedule 80 thread-to-thread elbows.

4. Copper Tubing: ASTM B 88, Type K.

5. Galvanized Fittings
a). All fittings shall be of the same materials as the pipe and galvanized, as manufactured by "Grinnel", or approved equal.
b). Use "Permatex" pipe compound for all threaded joints.

2.3 OUTLETS

A. Manufacturers
1. As specified on the contract drawings
2. No product substitutions shall be permitted except those approved by the Landscape Architect.

B. Quick-Coupling Valves
1. Valve and key shall be the manufacturer indicated on the Drawings or an approved equal.
2. Furnish two (2) valve keys fitted with three-quarter inch (3/4") swivel hose ells.

C. Rotor Heads
1. Rotor heads shall be the manufacturer indicated on the Drawings or an approved equal.
2. See irrigation plan legend for model #.

3. Provide check valve option for heads on irrigation zones that have differential slope conditions.
4. All pop-up bodies shall have a pressure reducing device installed.

D. Spray Heads
1. Spray heads shall be the manufacturer indicated on the Drawings or an approved equal.
2. See irrigation plan legend for model #.
3. Provide check valve option for heads on irrigation zones that have differential slope conditions.
4. All pop-up bodies shall have a pressure reducing device installed.

2.4 VALVES

A. Quick Coupling Valves: Hunter HQ-3RC, or approved equal - shall have heavy duty brass construction, durable thermoplastic rubber cover, stainless steel internal valve spring, one-piece body design. Provide two valve keys with 3/4 inch swivel hose ells.

B. Gate Vales:
1). Gate Vales 3" and under: Brass construction; solid wedge; IPS threads; and non-rising stem with cross handle; 200 PSI hydrostatic test pressure. 125 lb. bronze construction, non-rising, as manufactured by "Grinnel", Red and White, or approved equal.
2). Gate Valves 3-1/2" and Over: Iron body, brass or bronze mounted AWWA gate valves with a clean waterway equal to full nominal diameter valve; rubber gasket or mechanical joint only; 200 PSI hydrostatic test pressure. by "Grinnel", Red and White, or approved equal.

C. Electric Remote Control Valves (Standard System Only)
1). Remote control valves shall be normally closed, 24 volt AC 60 Cycle, solenoid actuated globe pattern diaphragm. Valve pressure rating shall be 200 psi minimum.
2). Valve body and bonnet shall be constructed of heavy duty glass-filled nylon. Diaphragm shall be nylon reinforced rubber. Solenoid coil shall be encapsulated in molded epoxy.
3). Valve shall be actuated by a low power, 2.0 watt 24 volt AC Solenoid.
4). Valve shall have a flow control stem with wheel handle for regulating or shutting off flow of water and a bleed plug for manual operation.
5). All valve integral parts shall be removable from top of valve without disturbing the valve installation.
6). Hunter ICV Series valve with pressure regulator, or approved equal, size as noted on plans.

D. Electric Remote Control Valves (Drip System)
1). See Specifications Section 328500 – Drip Irrigation

E. Electric Remote Control Valve Tags
Remote control valve tags shall be manufactured from polyurethane Behr Desopan and shall be 2.25” x 2.75” hot stamped with 1 1/8” black letters on a yellow background. Christy Irrigation I.D. Tags", or approved equal.

F. Backflow Prevention Device:
1. Install pressure-type backflow preventer at required grade per applicable plumbing code. All exposed main line and main line risers above PVC main elevation, shall be type "K" copper. Install one (1) brass union in riser downstream, or device.
2. Wrap all controllers with foam-type insulation.

G Backflow Prevention Device Enclosure:
1. Powder coated, expanded steel enclosure.
2. Concrete base enclosures shall be provided with galvanized or stainless steel mounting template and “hook” bolts for setting the template into the concrete base. Contractor to provide a minimum 4” thick concrete base that is large enough to adequately secure the cabinet in place and extends 4” beyond the extent of the enclosure
3. Extend water service pipes up through concrete base.
4. Provide six (6) sets of keys to Owner.
5. Manufacturers: Guard Shack or Strong Box, or other approved manufacturer.

2.5 VALVES BOXES

A. Valve Boxes
1. Valve boxes shall be injection-molded of polyesters and fibrous inorganic, temperature-resistant components. Box shall provide adequate clearance to operate and service valve. Box and lid to be black, as manufactured by Carson Industries, Inc., LaVerne, California (or approved equal).
2. Remote Control Valve Boxes shall be rectangular, approximately ten inches by fourteen inches (10" x 14"), and shall be approximately fifteen inches (15") deep. Model #1419-12 with 1419-2 hinged cover. Extensions for rectangular boxes shall be Carson #1419E-12(or approved equal).
3. Gate Valve and Quick Coupler Valve boxes shall be round, approximately nine inches (9") inside diameter by ten inches (10") deep. Model #910-12. Extensions for round boxes shall be Carson #910E- 12(or approved equal).

B. Valve Keys: "Champion" #30, thirty inches (30") long, or equal. Furnish two (2) keys.

2.6 CONTROLLERS

A. Manufacturers

1. All controllers shall be positively grounded to a three-quarter inch (3/4") copper rod, driven a minimum of forty-two inches (42") into the ground. All units shall come equipped from the manufacturer with complete lighting and power surge protection.
2. See Drawings for controller type

B. Controller Enclosures

1. Controller enclosure shall be made of stainless steel and be weather proof with a NEMA-4/IP66 rating. Access door shall be fully gasketed.
2. Enclosure shall be vented, with flush mounted, stainless steel locks, and with accessible bottom.
3. Wall Mounted Cabinets: Wall mounted cabinets shall have external mounting tabs or flanges with pre-drilled or knockout entry holes on the cabinet bottom.

2.7 CONTROL WIRES

A. Wire: Solid copper wire, U.L. approved for direct burial in ground. Minimum gauge: #14 U.F. Common ground wire shall be white.

B. Extra Wire: Supply a minimum of one (1) extra wire for each direction of mainline run. Extra wire shall be of a fugitive color, loop at each valve for future use.

C. Splicing Material: King Outdoor/Irrigation Dryconn Waterproof connectors, size as needed (use connector for each splice).

2.8 CONTROL WIRE SPLICE BOXES

A. Control wire splice boxes shall be heavy duty concrete 10 inch diameter by 10-1/4 inch deep with cast iron cover, or approved equal.

B. Gravel backfill for valve boxes and control wire splice boxes shall be 3/8 inch diameter pea gravel.

2.9 SLEEVES UNDER PAVING FOR CONTROL WIRE AND IRRIGATION LINES

A. ASTM D 2466, PVC, Schedule 40, sized as shown on drawings.

B. Main Lines: Shall be six inch (6") Schedule 40 PVC piping.

C. Lateral Lines: Size per drawings

D. Control Wiring: Use two inch (2") Schedule 40 PVC for remote control wiring if as installed separately. When irrigation control wire is to be run in the same sleeve as irrigation mainline, contractor shall utilize a one-inch (1") Schedule 40 PVC sleeve with one (1) continuous pull chord. For controller power feed, use

3/4" galvanized steel, unless otherwise specified on the drawings or existing in the field.

2.10 CONCRETE FOR THRUST BLOCKS

A. Portland Cement: shall conform to current requirements of ASTM Designation C150, Type I or II cement.

B. Coarse Aggregate: Coarse aggregate for regular-weight concrete shall be hard, durable, uncoated, washed, graded, cleaned and screened crushed rock or gravel, conforming to current requirements of ASTM Designation C33.

C. Concrete shall be designated to surpass compressive strength of 3,000 PSI.

2.11 WATER METERS AND TAPS

Irrigation system water meter and tap materials and construction shall be in accordance with the requirements of the Applicable City and in accordance with all applicable specifications included in Volume 2 of these specifications.

PART 3 EXECUTION

3.1 SYSTEM DESIGN

A. Design Pressures: Pressure shall be as indicated on Drawings, and as measured at last head in circuit.

B. Location of Irrigation Lines: Design location is represented as accurately as possible, but the Irrigation plan drawings are conceptual. All irrigation mains, laterals, and equipment shall be located within the planting areas unless where noted to be within designated irrigation sleeves and/or bores. The Contractor may make minor adjustments on site with approval of the Landscape Architect or Owner's Representative as necessary to ensure consistent and even spacing where applicable.

C. Adjustments to System: Suggestions for changes in location of piping, etc., advisable in the opinion of Contractor, shall be submitted to the Landscape Architect or Owner's Representative for approval before proceeding with the work, with written assurance that such changes will not cause any extra cost on their part or alteration of design requirements. Contractor shall route piping to avoid existing and proposed trees, planting areas, or structures.

B. Location of Irrigation heads: Irrigation heads shall be set back twelve (12") beyond back of curbs, pavement areas, buildings and any other hardscape obstruction.

3.2 INSPECTION

A. General: Examine areas and conditions under which irrigation system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. The Contractor shall inspect the site and become familiar with the conditions upon which he will receive same. The Contractor shall not mobilize his work force until such time as the site is suitably prepared for completion of the work. If the contractor begins work without reporting unsuitable conditions to the Landscape Architect or Owner's Representative this constitutes acceptance of the work conditions by the contractor. Any further removal, repair or replacement of this work caused by unsuitable conditions shall be performed by the contractor at not additional cost to the Owner

C. Verify the exact location of all existing surface and underground utilities and structures. The landscape architect does not assume responsibility for inaccurate, incomplete, or missing existing utility information depicted on the contract drawings. The contractor shall note any utility discrepancies, as they are encountered, on a set of drawings to be included in the project "as-built" drawings.

D. Verify that required utilities are available, in their proper location, and ready for use.

E. The Contractor shall protect existing structures and utility services and be responsible for their replacement if damaged by him, or make necessary adjustments in their location, if required, in order to complete the work of this Contract.

3.3 PREPARATION

A. Layout and locations of all piping, sprinkler heads, and other irrigation components for approval by Landscape Architect prior to trenching.

B. Review layout requirements with other affected work. Coordinate locations of irrigation sleeves under pavement to accommodate the layout of the system

C. Should any changes be deemed necessary after award of contract for proper installation and operation of the system, such changes shall be negotiated by the Landscape Architect or Owner's Representative, based upon the enclosed unit price.

D. In no case shall spacing of sprinkler heads exceed the distances shown on the drawings and/or those specified in the irrigation legend. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged

or rejected because of defects shall be removed from the site at the time of rejection.

E. Piping, sprinkler head, and other irrigation components layout is diagrammatic only. It is the intent that piping and irrigation components be located in turf or planting areas, except were the system crossing existing or proposed paving or hardscape areas. Contractor shall route piping to avoid existing and proposed trees, planting areas, or structures.

3.4 INSTALLATION OF SITE SAFEY SIGNAGE

A. General: Maintain all warning signs, shoring, barricades, flares and red lanterns as required by safety orders of the Division of Industrial safety and local ordinances.

3.5 EXCAVATION AND BACKFILLING

A. General: Excavate straight and true with bottom uniformly sloped to low points. Protect existing lawns and plantings. Remove and replant as necessary to complete installation. Replace damaged lawn areas and plants with new products to restore to existing installation's original condition.

B. Excavating and Trenching

1. The Contractor shall perform all excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins. The contractor shall trench, each day, only as much as required for that day's work.
2. Installation of main and lateral lines by the vibratory flow method will not be allowed.
3. Minimum Cover: Trenches shall be made wide enough to allow minimum of two (2) inches between parallel pipe lines 2 inches and smaller and 6 inches for pipes 2 –1/2 inches and larger. A minimum of 12" is required for other utility services. Pipes shall be laid out with horizontal clearance between lines and not stacked.
   The following minimum cover depths from finish grade as follows:
   a). 24" minimum cover over main lines.
   b). 12" minimum cover over control lines from controller to valves.
   c). 12" minimum cover over lateral lines.
   d). 4" maximum cover over drip tubing line.
4. Minimum Trench Width: Twelve inches (12) unless otherwise noted on the drawings.

C. Backfill

1. Backfill with clean material from excavation after obtaining Owner's approval. Remove organic material, as well as rocks and debris larger than 1 inch in diameter. Place acceptable backfill in 6 inch lifts, compacting each lift.

2. Existing Lawns: Where trenching is required across existing lawns, (or in event of changes or repairs after new lawn has been established), uniformly cut strips of sod 6 inches wider than trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted.
   a). Backfill trench to within 6 inches of finished grade and compact. Continue fill with acceptable topsoil and compact to bring sod even with existing lawn.
   b). Replant sod within 2 days after removal, roll and water generously.
   c). Resod and restore to original condition all sod areas not in healthy condition equal to adjoining lawns 30 days after replanting.
3. Backfill trench and compact to subgrade elevations to finish grade at a minimum of 95% density under pavement and 85% under planting areas.
4. After the system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.
5. After backfilling and water settling, soil, around pop-up heads shall be tamped and heads left level with grade and plumb.
6. Compact trenches in areas to be planted, by thoroughly flooding the backfill.
7. Gravel for backfilling quick-couplers, remote control valve boxes and rotor heads shall be three-eighths inch (3/8") diameter "pea gravel".

3.6 INSTALLATION

A. General: Unless otherwise indicated, Contractor shall comply with requirements of the Uniform Plumbing Code, latest edition, Applicable City Plumbing Code, and ASTM F 690.
   1. Install pipes, valves, controls, outlets, and any other irrigation components in accordance with manufacturer's instructions.
   2. Connect to existing utilities as required.
   3. Set outlets and box covers at finish grade elevations.

B. Line Installation
   1. Piping Mains and Laterals: Lay out sprinkler mainlines and perform line adjustments and site modifications to laterals prior to excavation. Lay pipe on solid subbase, uniformly sloped without humps or depressions. All pipe, fittings, and valves, etc. shall be carefully placed in the trenches. Interiors of pipe shall be kept free from dirt and debris. When pipe lying is not in progress, open ends of pipe shall be tightly closed.

   2. All lateral connections to the mainline, as well as all other connections shall be made to the side of the mainline pipe. No connections to the top of the line shall be allowed. Pipes shall be bedded in at least two inches (2") of finely divided material with no rocks or clods over one inch (1")

diameter, to provide a uniform bearing. In common trenches, do not allow pipe to overlap.

3. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction, as recommended by the manufacturer.
4. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner as to ensure a square cut. Burrs at cut ends shall be removed prior to installation, so that a smooth, unobstructed flow will be obtained. Use tinted primer to aid in visual inspection.
5. All plastic-to-plastic joints, except polyethylene, shall be solvent-weld joints or slip-seal joints.

C. Piping
1. PVC Pipe Assembly: Apply a thin even flow coat of PVC solvent cement to inside of the fitting and pipe mating surface. Cure joints as recommended by the manufacturer and keep pipe and fitting out of service during curing period. Construct watertight joints equal or greater in strength than the pipe. Do not tap pipe at fittings.
2. Install plastic pipe in dry weather, when temperature is above 40 degrees F. and in accordance with manufacturer's written instructions. Allow joints to cure at least 24 hours at temperature above 40 degrees F. before testing.
3. Plastic pipe shall be snaked in the trenches in a manner to provide for expansion and contraction as recommended by pipe manufacturer.

D. Solvent-Weld Joints for Plastic Pipes
1. Thoroughly clean all pipe and fitting edges with a clean, dry cloth.
2. Apply a uniform coat of primer to the outside of the pipe and the fitting.
3. Apply a uniform coat of solvent to the outside of the pipe first, and then inside the fitting. Apply a second coat of solvent to the outside of the pipe, and quickly insert it into the fitting.
4. Give the pipe or fitting a quarter turn to ensure even distribution of the solvent, and make sure the pipe is inserted to the full dept of fitting socket.
5. Hold in position for fifteen (15) seconds.
6. Wipe off excess solvent that appears at the outer shoulder of the fitting. Care should be taken so as not to use an excess amount of solvent, causing an obstruction to form on the inside of the pipe. The joints shall be allowed to set at least twelve (12) hours before pressure is applied to the system.

E. Threaded Joints for Plastic Pipes
1. Use "Permatex" pipe compound on the threaded PVC fittings, except where Marlex fittings are used.
2. Use strap-type friction wrench only. Do not use a metal-jawed wrench.

F. Threaded Joints for Galvanized Steel Pipes
1. Factory-made nipples shall be used wherever possible.
2. Apply pipe-joint compound to male threads only.

G. Valves:
1. Quick Coupling Valves:
a). Connect quick coupling valves to irrigation mains by installing a Schedule 40 galvanized swing joint and piping between the quick coupling and the gate valve.
b). Swing joints at quick couplers shall have threaded fittings with liquid Teflon sealant.
c). Install specified nine inch (9") round box and pea gravel. Top of quick coupler shall be four inch (4") below top of box. Fill box with pea gravel to six inches (6") below top of box.
d). Use new and undamaged pre-assemble quick coupler swing joint, using brass nipples and fittings as shown on details. Use Teflon tape for all threaded joints.
e). Test swing joint and quick coupler by pressuring to specified main line pressure. All joints should withstand pressure, while still being flexible.
f). Stake quick coupler assembly with specified rebar and two (2) hose clamps.
2. Gate Valves:
a). Install isolation and branch gate valves directly on main.
b). Where gate valves isolate branch mains of a smaller size, size valve to largest main and add reducing fittings down stream of valves.
c). Place gate valve on minimum of four inches (4") of pea gravel. Place to cover pipe fully, while leaving handle fully exposed.
d). Install specified "Carson" box and "Carson" extension over valve. Box and extensions should extend from finished grade to top of pipe.
3. Remote Control Valves:
a). Valve installation shall include setting of the specified valve box to proposed grade. All valves shall be tee'd off the main, to facilitate setting at six inches (6") below grade, measured at the top of the handle.
b). Group together, where practical, valve boxes. Place no closer than eighteen inches (18") to walk edges, buildings and walls.
c). Gravel Backfill: Set valves in a bed of four inches (6") of pea gravel, and fill to cover half of valve body.
d). Adjust automatic control valves to provide flow rate at rated operating pressure required for each irrigation section.
e). Install valves in valve boxes, arranged for easy adjustment and removal. Locate valves to ensure ease of access for maintenance

such that no physical interference with other elements of the project exists.

f). Remote Control Valve Tags: One Remote Control Valve Tag shall be attached to stem of each electric remote control valve. Tags shall be numbered sequentially. Numbers shall correspond to station numbers in electric controller. Provide tags and corresponding numbers for wires pulled for future valves.

g). Valve Boxes: Install valve boxes to cover electric remote control valves. Install two valves maximum in valve box where possible. Top of valve box shall be flush with finished grade. Bury minimum 2 bricks under base of each box as support.

H. CONTROL WIRES

1. Install control wires with sprinkler mains and laterals in common trenches, wherever possible. Lay to the side of pipe line. Snake wires in trench, to allow for contraction of wires. Tie wires in bundles at ten foot (10') intervals with 3/4" black electrician's tape.
2. Control wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than five hundred feet (500'). Splice each connection in a separate "Scotchlock Sealing Pack". Place all splices in nine inch (9") diameter boxes.
3. Coil control wire and extra wire at each remote control valve connection. Coil by neatly wrapping wire around a section of pipe, ten (10) wraps before splicing. Similarly coil all control wires at each end of all sleeves and where wire changes direction.
4. Install one (1) extra control wire to the control valve located the greatest distance from the controller in each direction, and label each blank end.
5. Install specified "Christy Irrigation Tag", or equal, to each valve wire before making final connection.
6. Separate color coding of control wires by controller is required, with a single fugitive color for all common ground wires.

I. CONTROL WIRE SPLICE BOXES:

1. Install control wire splice box to cover any splice in control wire. Top of valve box shall be flush with finished grade.
2. Bury minimum 2 bricks under base of each box as support. Install control wire splice box to cover wires pulled for future valves.

J. BACKFLOW PREVENTERS

1. Make required connection to water supply according to local codes and manufacturer's written instructions.
2. Install pressure type backflow devices at required grade in accordance with the *Applicable City Plumbing* Code. Exposed mainline and mainline risers above PVC pipe main elevation shall be copper. Install one brass union in riser downstream of device.

K. SPRINKLER SWING JOINTS
1. Install swing joints, as shown on drawings.
2. All joints shall be hand-tightened to eliminate leakage, but loose enough to remain flexible.
3. Where possible, make all connections to the bottom of the sprinkler body. Avoid side connections, except for planter box applications.
4. All head height adjustment shall be made through the swing joint. When adjusted to grade, sufficient adjustment shall remain to facilitate raising or lowering at a later date.

L. SPRINKLER INSTALLATION
1. All sprinkler heads and quick-coupling valves shall be set perpendicular to finished grade. Sprinkler heads adjacent to existing walls, curbs and other paved areas, except street edges, shall be set to grade no closer than six inches (6") to such features. Sprinkler heads adjacent to driveways or roadways shall be set to grade no closer than twelve inches (12") to such features.
2. Flush system prior to the installation of sprinkler heads.

M. RAIN DETECTOR
1. Rain Detector as specified with the specified ET based controller, See Drawings.

N. ELECTRICAL, AUTOMATED CONTROLLER
1. Install the specified controller units in specified enclosures.
2. Install per local code and manufacturer's latest instructions.
3. All controllers shall be fully grounded and shall include manufacturer-approved lightening protection. A licensed electrician shall connect the supply electricity for the required controllers.

O. CONCRETE THRUST BLOCKS
1. Install where the rubber-gasketed irrigation main changes direction, as at ells and tees, and where the rubber-gasketed main terminates.
2. Pressure tests shall not be made for a period of thirty-six to forty-eight (36-48) hours following the completion of pouring the blocks.
3. Blocks for these mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications. Blocks shall be placed to take all thrust created by the maximum internal water pressure.

P. WATER METER(S)-IF APPLICABLE
1. Secure the necessary permits from the local water authority
2. Make required connections to water meter per the requirements of the local water authority codes.

Q. IRRIGATION BORES
1. All borings shall be performed with a water-lubricated rotary machine.
2. All bores shall be a minimum of eighteen inches (18") below any pavement, or at a depth required by applicable agency code.
3. For bores greater than two inches (2"), a maximum pilot diameter of two inches (2") shall be used, with reamers for larger bores at a maximum of two inch (2") increments
4. Sleeving shall be immediately installed, as part of the boring operation.
5. Provide shoring, if required, to eliminate subsidence from under pavement structures.
6. Report any irregularities and obstructions in the boring process to the Landscape Architect or Owner's Representative

R. CONDUITS AND SLEEVES
1. Furnish and install conduit where control wires pass and irrigation lines pass under or through curbs and/or pavement.
2. Conduits for wiring to be of adequate size to accommodate retrieval for repair of wiring and shall extend twenty-four inches (24") beyond edge of walls. Minimum size shall be four inches (4"), unless otherwise noted.
3. Install sleeves for all pipes passing through or under walls, walks, and paving. Sleeving to be of adequate size to accommodate retrieval for repair and wiring, or piping, and shall extend twelve inches (12") beyond edge of paving or other construction, where possible, eighteen inches(18") for roadway paving. Minimum size shall be six inches (6"), unless otherwise noted.
4. Contractor shall provide temporary, vertical extensions with caps to extend 24" above finished grade.
5. Multiple sleeves shall be a minimum of four (4") inches apart horizontally.

3.9 FIELD QUALITY CONTROL

A. General: Notify Landscape Architect, or Owner's Representative, a minimum of forty-eight (48) hours in advance when testing will be conducted. Conduct tests in presence of Landscape Architect, or Owner's Representative Tests to include, but are not limited to:
1. Trenching.
2. Pressure supply line installation and testing.
3. Lateral line and electrical valves.
4. Coverage tests.

B Hydrostatic Mainline Test:
1. Test irrigation main line, before backfilling trenches, to a hydrostatic pressure of not less than 100 psi for one (1) hour. Cap risers as needed. Piping may be tested in sections to expedite work.

2. Remove and repair or replace piping and connections which do not pass hydrostatic testing.
3. System shall not lose more than one and one-half (1-1/2) gallons of water in one (1) hour.
4. Testing and any subsequent repairs shall be accomplished at the expense of the Contractor

C. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place and dripper lines and/or irrigation heads are adjusted to final position.
1. Contractor shall demonstrate to Landscape Architect, or Owner's Representative that system meets coverage requirements, is as specified and indicated, and that automatic controls function properly.
2. Coverage requirements are based on operation of one circuit at a time.
3. Line Flushing:
   a). After all piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, yard hydrant assemblies, and hose valves, thoroughly flush piping system under a full head of water.
   b). Maintain flushing for 3 minutes though furthermost valve.
   c). After flushing, cap all risers.
3. Adjusting Irrigation Heads:
   a). Flush and adjust all sprinkler heads for optimum performance and to prevent over-spray onto walks, roadways, and buildings.
   b). If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, make such adjustments prior to planting. Adjustments may include changes in nozzle sizes and degrees of arc as required.
   c). Lower raised sprinkler heads within 10 days after notification by Contracting Officer.
   d). Sprinkler head adjustments shall be at the cost of Contractor
4. Adjusting Dripper Lines:
   a). Lower dripper line that are not a minimum of 4" below finish mulch surface.
   b). Reconnect loose fittings as necessary..
   c). Realign dripper lines to specified spacing.
5. Testing:
   a). Prior to backfilling, test system for leakage at main pressure piping at 125PSI for four(4) hours. The system is acceptable if no pressure loss is observed during the test period. Contractor shall prove water tightness.
   b). Testing of pressure main lines shall occur prior to installation of electric control valves. Sustain pressure in lines for not less than 2 hours. If leaks develop, replace joints and repeat test until entire system has been accepted.

c). Test piping on the non-pressure side of control valves after system is operational, by observing for leaks in pipe trenches and valve boxes.

d). Inspect all valves, and irrigation components for leakage during the test.

e) Test backflow as required by the applicable City.

f) Complete test before ground cover is planted for spray heads, and after planting is in place for dripper line installations.

6. When the irrigation system is completed, perform a coverage test in the presence of the Contracting Officer to determine if the water coverage for planting areas is complete and adequate. Correct inadequacies of coverage due to deviations from Drawings. Complete test before ground cover is planted.

3.10 CLEAN UP

A. Keep all areas of work clean, neat and orderly at all times.

B. Paved areas shall be kept clean during installation.

C. Clean up and remove all debris from the entire work area so that site is left neat and clean.

3.11 DEMONSTRATION AND INSTRUCTIONS

A. After completion and testing of the system, the Contractor will instruct the Owner's personnel in the proper operation and maintenance of the system.

B. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance material as basis for demonstration.

C. Develop an irrigation spray time schedule for each zone for both the immediate plant material establishment period (±90 days) and for the long-term operation of the system (1 year maintenance period)

3.12 PROTECTION

A. Contractor shall be responsible for work until issuance of Notice of Final Acceptance. After delivery, and before and after installation, protect work against theft, injury or damage. Protect open ends of work with temporary covers or plugs during construction, to prevent entry of obstruction material.

3.13 MAINTENANCE

A. Contractor shall correctly maintain the irrigation system during the installation process and throughout the landscaping maintenance service period.

B. Contractor shall provide Record Drawings showing dimensioned location of valves, meters, vacuum breakers, controllers, and mainline.

3.14 SPARE PARTS

A. Upon completion of the installation, turn over the following spare parts and specialty tools to the owner's authorized representative. Include with the following quantities of items a list of each part with appropriate part number (for ordering replacement products) and local supply store of where these parts can be purchased.

3.15 WARRANTY

A. In addition to manufacturer's guarantees or warranties, all work shall be warranted for one (1) year from the date of Substantial Completion against defects in material, equipment and workmanship by the Contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment, and workmanship, to the satisfaction of the Owner. This shall not be interpreted to include damage caused by vandalism, accident or the result of activities by other parties.

B. The irrigation Contractor shall submit a letter of warranty, through the prime Contractor, containing the following paragraph:

C.

"We hereby guarantee that the sprinkler irrigation system that we have furnished and installed is free from defects in materials and workmanship. The work has been completed in accordance with the drawings and specifications, ordinary wear and tear, and/or unusual abuse or neglect, excepted. We agree to repair or replace any defects in material or workmanship which may develop during the period of one year from the date of acceptance, and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time, after receipt of written notice by Certified Mail from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand."

PROJECT_____ LOCATION_____

ADDRESS_____

DATE OF ACCEPTANCE_____ TELEPHONE_____

PRINTED_____ SIGNED_____

END OF SECTION

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SECTION 32 91 19

LANDSCAPE GRADING

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for general site earth work not associated with structural foundation excavation and backfilling

B. Perform earthwork as shown and specified. The work includes, but is not limited to:

1. General site grading, to include excavation and filling to indicated elevations, profiles and contours.
2. Shaping of landscape berms.
3. Excavations and backfilling for culverts, pilings, and foundations.
4. Excavation of pedestrian pavement areas.
5. Rough and fine grading of landscape areas.
6. Subbase materials, drainage fill, common fill materials for slabs, pavement and site improvements.
7. Contactor to provide suitable fill material from off-site, if on-site material quantities are insufficient or unacceptable. Stockpile excess excavated material at a location designated by the Landscape Architect or Owner's Representative.

1.2 RELATED SECTIONS

A. Section 329500 – Tree Preservation

B. Section 329300 – Turfs and grasses

C. Section 329350 – Planting

D. Section 329150 - Topsoil

1.3 QUALITY ASSURANCE

A. Comply with Division 1 requirements.

B. Materials and methods of construction shall comply with the City, County, and State of Texas Standards.

1.4 PROJECT CONDITIONS

A. Promptly notify the Landscape Architect or Owner's Representative of unexpected sub-surface conditions.

B. Grade at excavation to prevent surface water draining into excavated areas.

1.5 GRADING TOLERANCES

A. Rough Grading: Rough grading is defined as grading to the final grade of subgrade, which shall be as follows (to be used as general guidelines only):

1. Hydroseed Lawns: ± One and one-fourth inches (1 1/4") from finished grade elevation
2. Solid Sod: Two and one-half inches (2 1/2") below finished grade
3. Footings: ± Two inches (2") below bottom of footing elevation, where subgrade material is not required.
4. Pavement: ± One and one-half inches (1 1/2") below subgrade material

1.6 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum): If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 – PRODUCTS

2.1 LANDSCAPE BERM FILL MATERIAL

A. Inert subsoil material, free of rubbish, debris, roots, and rocks greater than 2" diameter and any other deleterious materials and shall adhere to the following gradation requirements.

1. No. 40 sieve- 80 percent
2. No. 200 sieve - no more than 50 percent

B. Suitable excavated materials removed to accommodate new construction may be

used as fill material subject to Landscape Architect or Owner's Representative's inspection and approval.

2.2 TOPSOIL FOR LANDSCAPE AREAS.

A. See Section 329300 – Turfs and grasses

2.2 LANDSCAPE STRUCTURES FILL

A. Structural fill is intended to achieve proposed elevation prior to placement of foundations for landscape structures

B. Gravel or sandy gravel free of organic and unsuitable materials within the following gradation limits.

1. 4" sleeve - 100 percent finer by weight
2. 1" sleeve - 60-100 percent
3. No. 4 sieve - 25-85 percent
4. No. 20 sieve- 10-60 percent
5. No. 50 sieve - 4-35 percent
6. No. 200 sieve - 0 – 5 percent

2.3 PLANTING BACKFILL MIX.

A. See Section 329400 – Planting Mix

PART 3 – EXECUTION

3.1 SITE PREPARATION

A. All work shall be performed under the direct supervision of the Contractor's designated superintendent. The above shall apply to all work, whether performed by the Contractor's own forces or sub-contractors.

3.2 SITE INSPECTION

A. The drawings do not purport to show all objects existing on the site.

B. Before commencing the work of this Section, verify with the Landscape Architect or Owner's Representative all objects to be removed and all objects to be preserved.

C. Locate all existing utility lines and determine all requirements for disconnecting, abandonment, and capping. Assistance in the location of all existing utilities can be obtained from the local utility companies.

D. Locate all existing active utility lines traversing or adjacent to the site, and determine the requirements for their protection.

E. Contractor shall protect all of existing utilities and for reporting utilities not shown in plan.

3.3 EXISTING UTILITIES

A. Before starting grading and excavation, establish the location and extent of any underground utilities in the work area. Exercise care to protect existing utilities during earthwork operations. Perform excavation work near utilities by hand and provide necessary shorting, sheeting, and supports as the work progresses.

B. Maintain, protect, relocate, or extend as required existing utility lines to remain which pass through the work area. Costs for this work, except as covered by the applicable utility companies, will be adjusted by the Owner.

C. Protect active utility services uncovered by excavation.

D. Remove abandoned utility service lines from areas of excavation. Cap, plug, or seal abandoned lines and identify termination points at grade level with markers.

E. Accurately locate and record abandoned and active utility lines rerouted or extended on project record documents.

3.4 ROUGH GRADING

A. All areas covered by the project, including excavated and filled areas and adjacent transition areas shall be uniformly grades so that subgrade surfaces are at the elevations noted. The subgrade surface shall be below finished grade, as specified herein.

B. Prior to commencing compaction, fills shall be brought to water content that will permit proper compaction, by either aerating the material, if it is too wet, or spraying the material with water, if it is too dry. Thoroughly mix each lift before

compaction, to assure uniform distribution of water content. Bring all fills to suitable elevations above grade, to provide for anticipated settlement and shrinkage thereof.

C. Clear the subgrade of stones larger than 4 inches (4") in any dimension, and of concrete, wood, construction debris, and other deleterious matter.

D. Uniformly smooth grading for all areas, including excavated and fill sections and adjacent transition areas shall be accomplished. The subgrade surface shall be reasonably smooth, compacted and free from irregular surface changes.

E. The Contractor shall raise or lower all rims of existing utility structures where there is a grade change and construct them flush with the new finished grade or in accordance with applicable government agencies.

F. Ditches and swales shall be finished to permit proper surface drainage.

G. All areas to receive fill and/or topsoil shall be scarified to a depth of four inches (4") by disking a minimum of two (2) directions, as required to obtain the specified depth of loose soil.

H. Fill material shall be spread in uniform lifts of not more than six inches (6") in non-compacted thickness.

I. Disc the first lift deposited into existing soil, to provide a transition horizon.

J. Take precautionary methods to reduce soil erosion onto public streets and, where necessary, remove immediately.

K. Grade surfaces to assure areas drain away from structures and to prevent ponding and pockets of surface drainage. Provide subgrade surfaces free from irregular surface changes and as follows:

L. Provide compaction control for all fill and backfill.

M. Water settling, puddling, and jetting of fill and backfill materials as a compaction method are not acceptable.

3.5 COMPACTION

A. Compact each layer of fill and scarify subgrade for all pavement areas, to not less than ninety-five percent (95%) maximum density. Compaction shall extend not less than five feet (5') beyond construction limit and pavement edges.

B. Where fill is required for planting areas, compact each layer of fill and scarify subgrade to not less than eighty-five percent (85%) maximum density.

C. All excavation, filling and compaction shall be subject to the approval of the Landscape Architect.

D. Where fill, backfill, or in-place materials are required to be compacted to a specified density, the maximum density for control shall be determined by using ASTM D1557 or ASSHO T180 methods. The results of these tests shall be the basis upon which satisfactory completion of work will be judged. Any area or portion thereof that does not meet minimum density requirements shall be re-worked and re-compacted until it meets the project density requirements.

E. No extra compensation will be made for suitable materials removed, manipulated and replaced, in order to obtain density. Any removal, manipulation, aeration, replacement, and re-compaction of suitable materials necessary to obtain the required density shall be considered as incidental to the excavation and embankment operations, and shall be performed by the Contractor at no additional cost to the Owner.

F. Stones or rock fragments larger than four inches (4") in their greatest dimension will not be permitted in the top six inches (6") of the subgrade.

3. 6 LANSDCAPE AREA FINISH GRADING

A. Uniformly distribute and spread stockpiled topsoil or excavated material to be used as finish grade backfill material. Do not use frozen or muddy material. Place during dry weather. Exercise precautions to keep the topsoil friable and porous. Do not handle or work topsoil when it is excessively wet, or during a rainfall. Do not place topsoil on any subgrade that has not been loosened or tilled, or allowed for drainage. Loosen and till the full depth of the topsoil and re-till any areas that become unduly compacted by vehicular movement.

B. The contractor may use on-site stripped topsoil provided that the Contractor has conducted a landscape soils analysis test to determine what, if any, amendments are needed for a uniform growth of turf.

C. Hand rake the surface, removing all clods and undesirable material greater than one half inch (1/2") from ground surface. Fill all low spots with specified materials and cut irregularities to the acceptance of the Landscape Architect.

D. An acceptable fine grade shall be free from depressions greater than four inches (4") over any given space of 25' except at grade transitions which shall be gradual and even.

E. During the finished grading operations, all swales and additional swales that may be required to drain areas shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water.

F. To prevent excessive weed growth in the lawn areas, the Contractor should be prepared to immediately install the lawn upon the completed and acceptable finished grade.

G. Topsoil to be imported from off-site for use as a topsoil shall be an enriched top soil conforming to Section 329200 – Lawns

H. Payment for topsoil finish grading shall be paid for per Section 329200 – Lawns.

I. Clean-up and protection:

1. Protect finish-graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and damaged areas.

2. Where construction operations or adverse weather disturbs completed areas, scarify, re-shape, and compact to required density.

3. After completion of fine grading and topsoil operations, do not drive trucks or other heavy equipment over finished areas.

3.7 DISPOSAL OF WASTE MATERIALS

A. Stockpile, haul from site, and legally dispose of waste materials, including excess excavated materials, rock, trash, and debris.

B. Maintain disposal route clear, clean, and free of debris.

C. Upon completion of the work, remove all debris and excess material from the site so that the area is left neat and clean.

3.8 CLEANING

A. Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment.

B. Provide site clear, clean, free of debris, and suitable for site work operations.

END OF SECTION

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SECTION 32 91 50

TOPSOIL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

B. Furnishing and placing topsoil from imported or on-site sources.

1.2 RELATED SECTIONS

A. Section 311000 – Site Clearing

B. Section 329350 – Tree Preservation

C. Section 392200 – Lawns

D. Section 392220 – Sports Field Turf

E. Section 392250 – Ornamental Grass Seeding

F. Section 329350 - Planting

G. Section 329450 - General Use Compost

1.3 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum): The Contract is a Stipulated Price Contract, payment for labor, materials, and all miscellaneous costs required as part of the work required in this Section is included in the total Stipulated Price.

PART 2 P R O D U C T S

2.1 IMPORTED TOPSOIL FOR LANDSCAPE USE

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics:

1. Soil Reaction pH 6-7 (a)

2. Passing No. 4 Sieve % 95-100

3. Sand Size, 2.0-0.05 mm % 10-70

4. Silt Size, 0.05-0.005 mm % 0-40
5. Clay Size, <0.005 mm % 20-50
6. Easily Oxidizable % 2.5-10 (b)

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of nut grass or other noxious weeds.

D. Imported topsoil shall satisfy the following property values or as directed by the Engineer:
   1. Determine pH by Method A, pH meter. If the imported topsoil does not satisfy the specified pH range, achieve the desired pH by applying soil amendments as recommended by the certified agronomist's report of soil sample analysis.
   2. Soil testing company shall identify test method used if different than listed above.
   3. Texas Plant and Soil Lab, Inc.
      FM 1925, Edingburg, TX 7854,
      Tel. (956) 383-0739, Fax (956) 383-0730
   4. Ammend soil as directed by soil testing results.

2.2 TOPSOIL FOR GRASSED BIOSWALE

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the characteristics as noted above in section 2.1 in addition to:
   1. Add 1 part expanded shale
   2. Shale shall come from approved sources

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C Topsoil shall be pre-blended or mixed on-site

D. Custom blended topsoil shall satisfy the following property values or as directed by the Owner's Representative and/or landscape architect:
   1. Determine pH by Method A, pH meter. If the imported topsoil does not satisfy the specified pH range, achieve the desired pH by applying soil amendments as recommended by the certified agronomist's report of soil sample analysis.
   2. Testing shall include percolation rates
   3.. Soil testing company shall identify test method used if different than listed above.
   4. Texas Plant and Soil Lab, Inc.
      FM 1925, Edingburg, TX 7854,
      Tel. (956) 383-0739, Fax (956) 383-0730
   5. Amend soil as directed by soil testing results.

2.3 ENRICHED TOPSOIL

A. Composition
   1. 75 % approved topsoil blend
   2. 25% general use compost
B. Premixed or blended on-site
C. Enriched topsoil shall have a minimum organic composition of at least 5%
D. Use where noted on the plans or within specific specifications sections

2.4 ON-SITE TOPSOIL STRIPPING

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics:

B. Topsoil may be stripped from the site through site grading activities if approved by the Landscape Architect or Owner's Representative in advance. Topsoil used from onsite shall come from the top +/-8" of the soil. The Contractor will be required to conduct a soil test, at no additional cost to the Owner, from on site for use by the Landscape Architect and/or Owner's Representative in determining if the on site topsoil is suitable for the proposed landscape work.

C. Import topsoil or provide from on-site material. Topsoil shall be easily cultivated, free from objectionable material including, gravel, large roots, stumps, wood, brush, debris, hard clods, clay balls, hardpan, refuse or other deleterious materials and be of reasonably uniform quality.

D. In the case of on-site or nearby source, topsoil is the surface layer of material containing decaying vegetable matter and fine hair-like roots.

E. Imported topsoil shall satisfy the following property values or as directed by the Landscape Architect or Owner's Representative.

F. On-site topsoil shall satisfy the following property values or as directed by the Landscape Architect or Owner's Representative.

1. Determine pH by Method A, pH meter. If the imported topsoil does not satisfy the specified pH range, achieve the desired pH by applying soil amendments as recommended by the certified agronomist's report of soil sample analysis.
2. Soil testing company shall identify test method used if different than listed above.
3. Texas Plant and Soil Lab, Inc.
   FM 1925, Edinburg, TX 7854,
   Tel.(956) 383-0739, Fax (956) 383-0730
4. Amend soil as directed by soil testing results.

G. See Section 329100 –Site Preparation

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that excavation and embankment operations have been completed to correct lines and grades.

3.2 TOPSOIL EXCAVATION FROM ON-SITE SOURCES

A. Strip off topsoil from the area to be excavated to a maximum depth of 8 inches, unless indicated otherwise on the Drawings. Only areas identified on the plans or approved by the Landscape Architect shall be used.

B. Stripping or placement or activity around the stockpile does not damage or impact any existing trees, shrubs or environmentally sensitive areas. Obtain appropriate clearances if such impacts are unavoidable.

C. Stockpile topsoil in a designated location for reuse. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.3 PLACEMENT

A. For areas to be seeded or sodded, scarify or plow existing material to a minimum depth of 4 inches, or as indicated on the Drawings unless the proposed topsoil is to be located in a Tree Protection Zone, See Specification Section 329340 - Tree Preservation. Remove vegetation and foreign inorganic material. Place topsoil on loosened material and roll lightly with an appropriate lawn roller to consolidate topsoil.

B. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of General Conditions.

3.4 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

3.5 SPREAD STOCKPILED AND CONTRACTOR-FURNISHED TOPSOIL

A. Clear area to receive topsoil of all trash, debris, weeds, and rock 3 inches or larger, and dispose of objectionable material in an approved manner.

B. Place and spread the stockpiled topsoil over the prepared slopes to the plan depths.

C. Disc or harrow the placed topsoil along the contour on slopes 3:1 and flatter or cat-track the slopes to create continuous cleat tracks that run parallel with the contours.

END OF SECTION

SECTION 32 93 50

PLANTING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies the requirements for installing, trees, shrubs, ground covers, and seasonal plants as indicated and scheduled on the drawings and specified herein.

B. The work shall include, but not necessarily be limited to, all labor, materials, samples and analysis, placement of prepared soil backfill mix, shredded hardwood bark mulch top dressing, maintenance, pruning, tree grate system installation, coordination with other trades, fertilizers, herbicides, and other post planting additives, excavation and backfill, equipment services and all other related items necessary to for the proper and complete installation of the work as well as maintenance and warranties.

C. Contractor will be required to notify the Landscape Architect or Owner's Representative at least forty-eight(48) hours prior major work activities during the planting installation. Major work activities include, but are not limited to, bed drainage installation, placement of prepared planter mix, and material installation and/or staking.

1.2 RELATED SECTIONS

A. Section 329400 - Planting Mix
C. Section 328000 - Irrigation
D. Section 328500 - Drip Irrigation.
E. Section 320190 – Landscape Maintenance

1.3 QUALITY ASSURANCE

A. Substitutions:
   1. Product substitutions, including, but not limited to species, size, manufacturer or type, are not permitted unless otherwise approved by the Landscape Architect or Owner's Representative. It is assumed that the contractor has reviewed the plant material at the time of Contract Bidding and has adequately located plant material that conforms to the Drawings and Specifications.
   2. The Contractor shall submit all requests to the Landscape Architect or Owner's Representative in writing with proper documentation and/or samples in a timely manner so as not to impact the project completion or installation of other work.

3. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract Price. Such proof shall be substantiated and submitted in writing to Landscape Architect and/or Owner's Representative at least fourteen (14) days prior to start of Work under this Section. Contractor shall provide written proof of at least three (3) vendors and/or material suppliers who have indicated that the material is not available per the requirements of the Drawings and Specifications.

B. Landscape Contractor Qualifications:
1. Contractor specializing in installing and planting plants with not less than five (5) years of documented experience
2. Contractor shall show evidence of having successfully completed similar work of this size and scope within the past two (2) years.
3. The Contractor shall be licensed by the Texas Association of Nurserymen, shall possess a current agricultural certificate, and shall be a licensed pesticide applicator.

C. Tree Pruning Qualifications: Company specializing in pruning trees with proof of current Arborist Certifications.

D. Quality Control:
1. Shrubs and Groundcovers: Provide plants of quantity, size, genus, species and variety shown and scheduled for planting work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock."
2. Shrubs shall adhere to the ANSI Z60.1 Type 1 Standards.
3. Provide health, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, larvae and defects such as knots, sun-scale, leaf tip burn, abrasions or disfigurement.
4. Compliance: Ship planting materials with Certificates of Inspection required by governing authorities. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste material.
5. Analysis and Standards: All packaged products shall be delivered in original manufacturer's sealed containers, for unpackaged materials submit analysis by recognized laboratory make in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
6. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.
7. The basis for plant nomenclature shall be Hortus III

E. Reference Standards
1. American National Standards Institute (ANSI) - Z60.1 : Nursery Stock.
2. American Association of Nurserymen (AAN).
3. National Arborist Association (NAA) - Pruning Standards for Shad Trees
4. Texas Association of Nurserymen Specifications (TAN) - Grades and Standards.
5. Association of Official Agricultural Chemists
6. NBS: National Bureau of Standards
   a). PS23: Perlite Product Standards

1.4 SAMPLES, TESTS, AND INSPECTIONS

A. Plants shall be subject to inspection and approval by Landscape Architect and/or Owner's Representative at the place of growth and upon delivery for conformity to specifications. Such approval shall not restrict the right of inspection and rejection at any time during progress of the Work. Contractor shall inform the Landscape Architect or Owner's Representative at a sufficient time prior to the shipping of plant material to request inspection of plant material at place of growth. Inspection at the place of growth shall be for general quality, size, and vitality and shall not in any way impair the right of rejection for failure to meet the specified requirements during the progress of the work.

B. Landscape Architect or Owner's Representative shall be responsible for final approval and tagging of all plant materials for the project. All travel and related costs for Landscape Architect or Owner's Representative to perform such tagging shall be borne by the Contractor.

C. Certificates of inspection required by federal, state, or other authorities for plant materials shall accompany each shipment of plants and shall be the responsibility of the Contractor.

D. Analysis and tests of materials, such as fertilizers, soil additives, prepared planting mixes, top soils, insecticides, etc., shall be made in accordance with the current methods of the Association of Official Agricultural Chemists. Certified analysis by a recognized laboratory shall be submitted by the Contractor, at his own expense, for the Landscape Architect or Owner's Representative approval prior to delivery to the site. Packaged and sealed standard products accompanied by the manufacturer's or vendor's analysis, complying with the requirements of the specifications will be accepted.

E. Approval of Materials shall not be construed as final acceptance and Landscape Architect or Owner's Representative reserves the right to analyze, for comparison with specifications requirements, any or all materials delivered for use under this section. The cost of such tests will be borne by the Contractor. Should these tests indicate noncompliance with the specifications requirements,

all rejected material shall be removed from the site and replaced with acceptable material.

F. Inspections – The Landscape Architect or Owner's Representative shall be notified at least forty eight (48) hours prior to the following critical inspection items during the work.
1. Plant material delivery.
2. Plant bed excavation prior to placing prepared backfill mix.
3. Placement of gravel layer and filter fabric landscape drainage materials.
4. Place of T-stub-out with cap in drainage header line.
5. Planting bed backfill mix placement including placement of all soil amendments, i.e., fertilizer, etc.
6. Planting of trees.

G. Completion of Work - Inspection of work to determine the completion of the Contract Requirements will be made by the Landscape Architect or Owner's Representative at the conclusion of all project work. The Contractor shall provide written notice requesting a final inspection at least seven calendar days prior to the anticipated date of Final Completion. After inspection, the Contractor will be notified in writing by the Landscape Architect or Owner's Representative of Final Acceptance of all Work in this Section, or if there are any deficiencies, of the requirements for the completion of the work.

H. Testing Lab -
1. The Contractor will be required to provide soil testing of proposed planter mixes and existing soils to receive hydromulched and/or solid sod turf.
2. The Contractor shall provide a planter mix that adheres to the recommendations of the soils test and modify as necessary.
3. Soil testing shall be a comprehensive macro and micro-nutrient soil test and shall be performed by the following soils laboratory at the cost of the Contractor:

Soil and Plant Laboratory Inc.(or as approved)
Texas Soil and Plant Lab
5115 W. Monte Cristo
Edinburg, Texas 78539
Tel: (956)383-0739
www.txplant-soillab.com

1.5 SUBMITTALS

A. Submit for approval by Landscape Architect and/or Owner's Representative, State or Federal certification stating that the plants are free from disease and insect infestation.

B. Fertilizer Certification: Fertilizer certification shall be submitted for review and approval by the Landscape Architect and/or Owner's representative. The certification shall include a chemical analysis of the fertilizer and a listing of the elements container therein and their percentages.

C. Maintenance Instructions: Submit typewritten instructions, including manufacturer's recommendations and instructions recommending procedures to be established by the Landscape Architect and/or Owner's Representative for maintenance of trees, palms, shrubs, ground covers, and annual/perennial plantings. Submit instructions prior to the expiration of the Contractor's maintenance period.

D. Plant life nursery sources: Landscape Architect shall be notified prior to shipping of plant material so that critical inspections can occur at the nursery (if applicable)

E. Submittals - Contractor to provide the following landscape material submittals for review and approval by Landscape Architect and/or Owner's Representative this shall be supplied at the expense of the contractor.
1. One (1) appropriately sized container of all prepared planter mixes and or top soils. Submit laboratory analysis of prepared planter mixes and top soils. Laboratory analysis' shall be current and must have been prepared within the thirty (30) days of the submittal.
2. One (1) appropriately size container of all mulches.
3. One (1) of each shrub, groundcover, perennial and annual plant material in suppliers' original container.
4. Trees: Unless otherwise required by Landscape Architect and/or Owner's Representative, provide a photograph with representative scale of each tree material proposed.
5. Palms: Unless otherwise required by Landscape Architect and/or Owner's Representative, provide a photograph with representative scale of each palm material proposed.
6. Other landscape supplies or components that are deemed necessary for work in this section.
7. Submit manufacturer's cut-sheets on other packaged and bagged materials as appropriate.

F. Nursery Inspections - All plants inspected at the nursery by the Landscape Architect shall be tagged with serialized self-locking tags. Trees delivered to the site without these tags or with broken tags may be sufficient reason for rejection.

G. All submittal data shall be forwarded in a single package to the Landscape Architect within ten (10) days of award of Contract.

1.6 DELIVERY, STORAGE, and HANDLING

A. Packaged Materials - Deliver packaged materials in full labeled, original containers showing weight, analysis, and name of manufacturer.

B. The Contractor shall protect and maintain plant life until planted.

C. Deliver plant materials for planting after bed preparation has been completed and plant immediately. If planting is delayed more than seven (7) hours after delivery, set plants in shade and protect from weather and/or mechanical damage.

D. Product Handling Recommendations:
   1. During hot weather and when practical, the Contractor may be required to transport plant materials between sunset and sunrise if transported in an open trailer or unrefrigerated van.
   2. The Contractor shall be solely responsible for the safe transportation of plants to the site and their condition upon arrival. Trees damaged, dehydrated or abused during transit and storage will be rejected.
   3. Plant materials should not be stored on concrete or left exposed to examples of climate without adequate protection.
   4. Protect the root balls and water regularly until planting. If trees are left in storage over the weekend or holiday provide a means of periodic watering and inspection of container moisture.
   5. Do not remove plant materials from containers before time of planting and water immediately after delivery and prior to planting.
   6. B&B, palms, or bare root material shall not be left unplanted for extended periods of time. If this situation occurs, keeps roots moist by covering with mulch or other acceptable means of retaining moisture and water thoroughly as needed.

E. The Landscape Architect may inspect any phase of this operation and may reject any plant material improperly handled during any point of this operation.

F. Nothing in this Section shall be interpreted as relieving the Contractor of his responsibility to provide healthy, viable plants, nor shall it have any affect upon the terms of the maintenance and warranty requirements as specified herein.

G. The Contractor is responsible for any costs to repair and/or replacement of any landscape material due to acts of vandalism, theft, or damage of any kind until issuance of Substantial Completion.

1.7 CONTRACTOR RESPONSIBILITY

A. The Contractor shall coordinate repairs of damage to the irrigation system incidental to the planting operation by either own forces or by Irrigation Subcontractor. Above repairs shall be made immediately so as to not interfere

with the automatic cycling of the irrigation system. All costs for such repairs shall be borne by the Contractor

B. The Contractor shall have examined all drawings and specifications relating to the work required and fully understand the requirements for the completion of the work. No considerations will be granted for any alleged misunderstanding of the materials to be furnished and/or installed and to the nature of the work to be done. It is understood that the tender of the Bid Proposal carries with it the agreement to all items and conditions specified, referred to herein, or indicated on the Construction Drawings.

C. The Contractor shall be liable for any damages to property caused by the operations under this Section and the Contractor shall, without any additional charge to the Owner, restore to their original conditions all areas and construction disturbed or damaged in pursuing the work of this Section.

D. Care should be taken to protect existing trees to remain. Contractor shall be held accountable for any damage to existing plant material. Under no circumstance shall the pruning of existing trees be done, unless explicitly directed by the Landscape Architect or Owner's Representative.

E. Contractor shall cooperate and coordinate work with all other Subcontractors in all operations, especially those of a critical nature, for the successful completion of the Work.

1.8 MAINTENANCE DURING THE CONSTRUCTION PERIOD

A. The Contractor shall maintain all plant material (excluding plant material provided by others, if applicable) within the limits of the Work in accordance with these Specifications, Section 320190 – Exterior Landscape Maintenance and as shown on the Drawings and as directed by the Landscape Architect or Owner's Representative until the expiration of the ninety (90) days after written notice of Substantial Completion.

1.9 GUARENTEES AND REPLACEMENTS

A. See Part 3 – Execution

1.10 MEASUREMENT AND PAYMENT

A. Stipulated Price(Lump Sum): If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

A. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least 12 (twelve) months unless specifically otherwise authorized by Landscape Architect or Owner's Representative in writing.

B. Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent future thriving growth.

C. Plants shall be true to species and variety indicated on the planting plan legend and shall conform to measurements specified.

D. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Caliper measurement shall be taken at a point on the trunk six inches (6") above natural ground four inches (4") in caliper and at a point twelve inches (12") above the natural ground line for trees over four inches (4") in caliper. If a range of size is given, no plant shall be less than the minimum size and not less than 40% of the plants shall be as large as the maximum size specified. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

E. Container stock shall have grown in the containers in which delivered for at least six months, but not over two years. Samples must prove no rootbound conditions exist. No container plants that have cracked or broken balls or earth when taken from container shall be planted. Container stock shall not be pruned before delivery. Field grown plants recently transplanted into containers will not be accepted. Trees, shrubs, and/or groundcovers that exhibit excessive root bound conditions will be rejected.

F. Balled and burlapped tree requirements.
   1. Nursery grown(processed) B&B material shall be first pruned and thinned at the place of growth immediately prior to digging as required for packaging and safe moving. Field grown B&B shall be considered so long as they meet the minimum specification standards.
   2. Do not remove self-locking tags during this pruning prior to delivery to site. Final pruning shall take place at the site.
   3. Ornamental and Shade Trees: Nursery grown (unless otherwise noted), healthy, vigorous, full-branched, well shaped, symmetrical, trunk diameter and height requirements as specified.

4. Balls on balled and burlapped (B&B) trees shall be firm, neat, slightly tapered and well burlapped. Trees (B&B and container grown) with loose or broken balls shall be rejected.
5. Trees shall be free of physical damage such as scrapes, bark abrasions, split branches, mistletoe or other parasitic growth.
6. Processed balled and burlapped root ball dimensions:

Shade Trees		Ornamental/Upright Tree	
Caliper	Min. Ball Dia.	Caliper	Min. Ball. Dia.
½ in.	12 in.	½ in.	10 in.
¾ in.	14 in.	¾ in.	16 in.
1 in.	16 in.	1 in.	18 in.
1 ¼ in.	18 in.	1 ¼ in.	19 in.
1 ½ in.	20 in.	1 ½ in.	20 in.
1 ¾ in.	22 in.	1 ¾ in.	22 in.
2 in.	24 in.	2 in.	24 in.
2 ½ in.	28 in.	2 ½ in.	28 in.
3 in.	32 in.	3 in.	32 in.
3 ½ in.	38 in.	3 ½ in.	38 in.
4 in.	42 in.	4 in.	42 in.
4 ½ in.	48 in.	4 ½ in.	48 in.
5 in.	54 in.	5 in.	54 in.
5 ½ in.	57 in.	5 ½ in.	57 in.
6 in.	60 in.	6 in.	60 in.
7 in.	70 in.	7 in.	70 in.
8 in.	80 in.	8 in.	80 in.

7. For field grown B & B add 4” of root ball dia. Per each category listed above.

H. Trees which have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 "which have not completely callused, will be rejected.

I. Each specified plant material shall be obtained and provided from a single source.

2.2 PREPARED PLANTING MIX

A. See Specification Section 329400- Planting Mix

B. Planting Pit Fertilizer: In addition to the fertilizer requirements of the planter mix, one of the following fertilizers shall be used in each planting pit for all trees, shrubs, and ground covers

1. Tablet form –Agriform 20-10-5 Planting Tablets shall be evenly placed in planting pits at the following rates or as recommended by manufacturer.
   a). 1 gallon/4" pot – 1/2 tablet or granular.
   b). 5 gallon container - 1 full tablet
   c). Tree - 3 full tablet evenly spaced around planting pit.
2. Granular form – Osmocote 13.13.13 + Iron by Sierra Chemical, 1-800-492-8255 Yosemite Dr. Milipitas, CA, or approved equal. Apply per manufacturer's recommendations for new plantings.

C. Herbicide:
1. Pre-Emergence Weed Control: In areas of Woody Ornamental Plants Eptam or Eptam-5-G as manufactured by Green Light Products Company, Missouri City, Texas 77459, (713) 438-6824 or approved equal.
2. Contact Weed Control: Roundup by Monsanto, 800 N. Lindbergh, St. Louis, MO 63167, (314) 694-1000 or approved equal.

D. Water:
1. To be furnished by Owner. .
2. Clean, fresh, and free of substances or matter which could inhibit vigorous growth of plants.

E. Pesticides: Apply specified insecticide to all trees at the rate included within the manufacturer's instructions as required for control of borers or ants.
1. Borers : Shall be Ortho "Lindane Borer and Leaf Miner Spray" Ortho, Consumer Products Division, Chevron Chemical Company, San Francisco, California 94119, or "Borer Killer", by Greenlight Company, San Antonio, Texas 78217.
2. Insecticide: Lindane with Adjuvant distributed by Esco Distributors, 514 W. 25th Street Houston, TX 77008, (713) 864-7771.
3. Fire Ant Control: Durzban or 1% Diazinon Granular as manufacture red by Green Lights Products Co., San Antonio, TX or Logic by PBI Gordon, Kansas City, Mo.

F. Root Stimulator: Root Stimulator shall be "Super Seaweed" root stimulator or approved equal as available from San Jacinto Environmental Supplies, Houston, Texas (713) 957-0909, attention Greg Cooper. Contractor shall water soak each root mass tree and planting bed wells at the time of planting.

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G. Gravel (for drainage): Shall be 3/4" to 1" diameter washed gravel. Limestone gravels will not be allowed.

H. Microrrhiza (for trees only): Rhizanova soil inoculants as available from San Jacinto Environmental Supplies, Houston, Texas (713)957-0909, attention Greg Cooper. To be used for each tree planting and applied per the manufacturer's recommendations.

2.3 MULCH MATERIALS

A. Top Dressing and Backfill Mix: Organic mulch free from deleterious materials and suitable for top dressing of trees pits and planting beds. Mulch shall be composed of well-rotted shredded hardwood bark mulch, black or dark brown in color.

B. Mulch Requirements:
1. Enriched Hardwood bark mulch with compost.
2. Mulch shall be of a high quality and shall contain less than 10% hard wood particles
3. Mulch shall have particle sizes ranging from 3/8” to 1”.
4. Mulch with recycled palettes or other wood products shall not be accepted.

C. Mulch shall be the product of standard stripping of bark from trees for fiber or pulp manufacturing. Bark shall be shredded in a manner where large pieces are at a minimum. The mulch shall be free of debris.

2.5 SOIL FABRICS

A. Filter Fabric : Filter Fabric (for drainage) shall be non-woven soil separator manufacture red by Mirafi, Dewitt or other approved equal with a minimum permeability rate of 200 gallons per square foot per minute.

B. Root Barrier: Root Barrier shall be a slow release, UV stabilized fabric embedded type. BioBarrier, 24” wide role, or approved equal as available from San Jacinto Environmental Supplies, Houston, Texas (713)957-0909, attention Greg Cooper.

2.6 ACCESSORIES

. A. Staking Materials (trees 4” in caliper or less)
1. Stakes: Pressure-treated 3" diameter lodge poles, "Wolman" treated, as provided by Bourbow Valley Company.
2. Ties: Black rubber tire or other tie, as approved.
3. Cable: Galvanized aircraft cable (7 x 19 GAC).
4. 12D Galvanized nails.
5. 3/8” x 6” galvanized turnbuckles, eye bolts, and 2-hole crimping clamps.
6. 2 Hole galvanized crimping clamps
7. Tree wrapping material: two layers of brown crinkled paper cemented together. Strips eight (8”) to ten (10”) wide

PART 3 EXECUTION

3.1 EXAMINATION

A. Test the plant beds and pits by saturating them with water. If standing water is observed after twenty-four (24) hours then notify the Landscape Architect.

B. If existing drainage conditions exist that may be detrimental to the proposed plant material, contractor shall notify the Landscape Architect prior to beginning excavation of any plant bed or pit.

C. If rock, hardpan, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits and beds, alternate locations may be selected by Landscape Architect. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than six (6") inches below the required pit or bed depth. Proceed with work after approval.

3. 2 LAYOUT

A. Layout all tree material locations in the field prior to installation for approval by Landscape Architect or Owner's Representative shown on drawings. Use wire stakes with color-coded flags, or wooden stakes with a visible color coding, for each species of tree material.

B. Layout out the limits of all major shrub and ground cover areas in the field prior to installation for approval by Landscape Architect or Owner's Representative.

C. If above or below ground obstructions are encountered notify the Landscape Architect or Owner's Representative as to whether an adjustment or change of location is possible within the design intent before beginning the installation.

3.3 EXCAVATION OF PLANTING AREAS

A. Subsoil work shall occur when the soil is pliable. Contractor shall avoid extremes of wet and dry weather periods. If the soil is excessively dry apply water so as to increase the soil moisture.

B. Excavate only those areas that can be planting during the working day. Open tree or planting pits will not be allowed over the night. Tree pits more than 24 hours in advance of planting operation.

C. Container Grown and B&B Tree Pit Dimensions(Bottom of tree well only, not including any proposed planting ledges for tree)

ITEM	WIDTH(at bottom)	DEPTH

Boxed Trees	Box X 2	Ball + 12 in.
Container Trees	Container X 2.	Container + 12 in.
B&B Trees	Ball X 3	Ball + 6 in.

Top of Tree Pit Dimensions: 2 times container or box , or 3 times root ball of B&B trees.

D. Shrub and Ground Cover Bed Dimensions (suburban and/or areas):

ITEM	WIDTH	DEPTH
Shrubs	Can + 1/2 can width	Can + 6 in., not less than 18"
1 Gallon Vines	Can + 1/2 can width	Can + 4 in., not less than 12 in. total

E. Shrub and Ground Cover Bed Dimensions (urban areas or in planters):

ITEM	WIDTH	DEPTH
Shrubs	Can + 1/2 can width	Can + 12 in., not less than 24"
1 Gallon Vines	Can + 1/2 can width	Can + 6 in., not less than 18 in.

3.4 TREE PLANTING

A. Tree container shall sit directly on native soil, tree cone ledge to be excavated by Contractor. The planter bed should slope away from the native soil cone ledge to the depth specified in the drawings and specifications.

B. Ball and burlapped tree
   a. Rest the root ball in the center of the hole, and reshape the hole so the tree will be straight and at the proper level. After adjusting the tree, pull the burlap and any other material away from the sides and top of the root ball. Do not remove the burlap from the bottom. If you adjust or lift the tree after the burlap has been removed you run the risk of damaging the root system.
   b. Balled and Burlapped (B&B) Plants: Dig and prepare shipment in a manner that will not damage roots, branches, shape, and future development.
   c. Balled and burlapped (B&B) plants shall have firm balls of earth. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during planting operations. B&B material shall be dug only when dormant. Pre-dug stored B&B material shall be inspected and approved at the storage site.
   d. Planting of B&B plants shall not occur in the months of June – September unless otherwise approved by the Owner's Representative or Landscape Architect

C. Contractor to excavate planter pit as indicated on the Drawings. Planter pit edges shall be vertical, except at the required soil cones. Set top root ball 3"-4" above natural grade where possible.

D. Contractor to add pit fertilizer, root stimulants, and micorrhyzal products into planting pit.

E. Contractor to lightly scarify the exiting tree root balls and loosen existing roots to promote root growth beyond the root ball.

F. Test the plant beds and pits by saturating them with water. If standing water is observed after twenty-four (24) hours then notify the Landscape Architect.

G. If existing drainage conditions exist that may be detrimental to the proposed plant material, contractor shall notify the Landscape Architect prior to beginning excavation of any plant bed or pit.

H. Provide specified tree staking, guying, or stapling (See Below)

I. Water backfill mix in thoroughly in 6” lifts, and water again after final mix materials is in place.

J. Contractor to create a mulch circles shall not exceed width of root mass by more than 4". Mulch circles shall meet lawn or bed grades evenly and smoothly. Contractor to add maximum of 3” of aged, shredded hardwood bark mulch dressing on top of planter pit included the top of the root ball.

K. Add root stimulants, fertilizers, and microrrhiza products as specified.

K. Container grown tree pit dimensions:
Excavate as shown on the planting details. Coordinate depths with landscape drainage plan and required soil tree cones.

L. Contractor to excavate only those areas that can be planting during the working day. Open pits will not be allowed, unless secured with fencing and covered with plywood or other suitable materials.

3.5 SHRUB AND GROUND COVER PLANTING

A. Set plants in pits or beds, partially filled with prepared soil mix to a depth equal to the bottom of the container and compact depth to receive plant root ball so that the top of root ball is a maximum of three (3") inches above finished grade.

B. Add planting pit fertilizer and root stimulants

C. Canned stock shall be removed carefully after cans have been cut on two sides with approved cutter. Do not lift or handle container plants by tops, stems, or trunks at any time.

D. Do not bind or handle any plant with wire or rope at any time so as to damage bark or break branches. Lift and handle plants only from bottom of ball.

E. Balled and burlapped (B&B) plants shall have firm balls of earth. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during planting operations. B&B material shall be dug only when dormant. Pre-dug stored B&B material shall be inspected and approved at the storage site.

F. Shrub and ground cover beds shall be completely and continuously excavated, no pit planting will be allowed.

G. Planting beds shall use a prepared planting mix only No native soil shall be used. Will be allowed.

3.6 INSTALLATION OF EXCESSORIES

A. Weed Barrier: Place weed barrier where indicated on drawings and provide cutouts for planting material as needed. Extend weed barrier down vertically a minimum of 4" at the edges of the planting beds.

3.7 PLANT SUPPORT

A. Tree Staking(trees 6" or smaller in caliper):

1. Refer to the planting details for an illustration of the proper tree staking procedures.
2. Plants shall remain upright after staking. The Contractor will be responsible for the material remaining vertical through the end of the warranty period. Trees that have sagged or fallen shall be corrected immediately by the contractor at no expense to the Owner.
3. Trees should be staked during the same day as planting.
4. Stake all trees under three and one half (3 1/2") inches in caliper measured 6" above the ground.
5. Contractor shall use three (3) - two (2") inch diameter lodge poles 10' in length for each tree to be staked evenly spaced around the perimeter of the tree.

3.8 TREE PRUNING

A. Prune containerized plants only at time of planting and according to standard horticultural practice to preserve the natural character of the plant. Prune by removing entangled branching and by removing crotches. Avoid removing branch tips wherever possible.

B. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools.

C. Prune lower branching from trees to a height of 18" about ground per 1 1/4" caliper.

D. Prune B&B material in addition to place of growth as may be directed by Landscape Architect by removing a percentage of interior branching proportional to the root loss during digging (up to 1/3).

3.9 POST PLANTING FERTILIZATION

A. Shrubs, Ground covers and planting beds.
   1. Apply fertilizer at 90 days after planting at the conclusion of the 90 day maintenance period.
   2. Microlife 'Ultimate' (8-4-6), 4 lbs per 1000 square feet of soil area at time of planting worked into the first 12 inches of the soil.
      San Jacinto Environmental Supplies
      Attention: Greg Cooper
      Houston, Texas
      (713) 957-0909.

B. Tree Planting
   1. Apply fertilizer 90 days after installation at the end of the 90 day maintenance period.
   2. Mix 40 lbs. of Arbor Green (30-10-7) per 100 gallons of water, or Ocean Harvest (4-2-3) at a rate of 1 to 2 oz. per gallons of water drench foliage and soil area thoroughly.
   3. Apply at a rate of 5 gallons of suspension mixture per 100 gallons of water.
   4. Inject material specified with a high pressure injector into soil at the drip line to a depth of 12"-18" at 3'-0" o.c.

Tree Caliper	Root Area (sq. ft.)	Circle Radius (feet)	Actual lbs Arbor-Green	Gallons of Mixture
1"	5.0	1'-4"	0.10	0.3
2"	21.5	2'-7"	0.43	1.0
3"	50.0	4'-0"	1.00	2.5
4"	86.0	5'-3"	1.73	4.0
5"	125.0	6'-4"	2.50	6.0
6"	200.0	7'-9"	4.00	10.0
7"	260.0	9'-1"	5.20	12.5
8"	345.0	10'-0"	6.93	16.5
9"	420.0	11'-6"	8.40	20.0
10"	500.0	12'-6"	10.0	25.0
12"	800.0	15'-10"	16.0	30.0

3.10 MAINTENANCE

A. The Contractor shall be responsible for the maintenance of all plant materials for a period of ninety (90) days from the time of Substantial Completion. In addition

the contractor shall be responsible for the maintenance and care of all plant materials up to and including the time of final acceptance by the Owner.

B. Contractor shall protect planting areas from any possible damage during this time and shall be responsible for any plants that area injured due to negligence on the part of the contractor.

C. Monitor plant watering cycles to prevent extremes of dry and wet soils to ensure proper plant growth. Adjust irrigation cycles accordingly.

D. Maintain planting beds and lawns in a weed free condition, applying appropriate herbicides as to control weed infestation.

E. Monitor planting materials for signs of insects and disease infestation and apply appropriate pesticides and fungicides as necessary to maintain plants in a healthy thriving condition. Repair, tighten, or restake any tree or palm support devices. Reset plants as necessary to maintain an upright position and relationship to the proper grades.

3.11 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Landscape Architect or Owner's Representative upon satisfactory completion of all work, including the ninety (90) day maintenance period, but exclusive of any necessary replacement of plant materials covered under the one year Warranty Period. Upon completion of the ninety (90) maintenance period the Owner will assume responsibility for maintenance of the work.

The Landscape Architect or Owner's Representative shall release all final payments and retainages except those pertaining to the ninety (90) day maintenance period. The contractor shall be responsible for submitting monthly invoices for the required maintenance as per the submitted bid. No retainages shall be removed from the monthly invoices.

3.12 WARRANTY

A. Planting material (including trees, shrub, ground covers, and ornamental grasses) shall be warranted by the Contractor to remain alive and healthy for a period of 12 months after the date of Substantial Completion. Plants in an impaired, dead or dying condition after initial acceptance or within 12 months shall be removed and replaced. New planting and method of placing shall comply with the requirements of the specifications. Plants replacing those removed during the guarantee period shall also be guaranteed to remain alive and healthy for an additional 12 months after installation and acceptance.

B. Contractor shall not be held responsible for failure due to neglect by Owner, vandalism, Acts of God, during Warranty Period. Report such conditions to the Landscape Architect in writing when discovered.

C. Submit a letter of warranty containing the following information:

"We hereby guarantee that the landscape planting we have furnished and installed is free from disease and in good condition, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted.

We agree to repair or replace any defects in material or workmanship which may develop during the period of one (1) year from acceptance, and also to repair or replace any damage resulting from the repairing or replacing of such defects, at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner by Certified Mail, we authorize the Owner to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore, upon demand.

PROJECT_____

SIGNED_____

LOCATION_____

ADDRESS_____

TELEPHONE_____

DATE OF ACCEPTANCE_____

END OF SECTION

SECTION 32 94 00

PLANTING MIX

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies the requirements for installing tree well and planting bed prepared planting backfill mix as indicated and scheduled on the drawings and as specified herein.

B. Work shall include, but not necessarily limited to, materials, products, samples and analysis, placement of prepared planting soil mix backfill, coordination with landscape contractor on the planting of materials, and all other items as necessary for the proper and complete installation of the Work.

1.2 RELATED SECTIONS

A. Section 329350 - Planting

1.3 QUALITY ASSURANCE

A. Soil and planter mix testing will be at the expense of the Contractor.

B. Soil Testing

1. The Contractor will be required to provide soil testing of proposed planter mixes and existing soils to receive hydromulched and/or solid sod turf.
2. The Contractor shall provide a planter mix that adheres to the recommendations of the soils test and modify as necessary.
3. Soil testing shall be a comprehensive macro and micro-nutrient soil test and shall be performed by the following soils laboratory at the cost of the Contractor:

   Soil and Plant Laboratory Inc (or as approved)
   Texas Soil and Plant Lab
   5115 W. Monte Cristo
   Edinburg, Texas 78539
   Tel: (956)383-0739
   www.txplant-soillab.com

C. Excavated material from tree pits can be used for preparation of tree backfill mix only so long as not debris, rocks, roots, or other deleterious material is found.

D. If herbicide contamination is suspected, then furnish a radish/rye grass growth trail.

E. For delivered material, test one grab sample for each 100 c.y. of bulk material delivered to the site.

F. Soils tests shall be a current test conducted within the previous 30 days.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to site when permitted by the Owner and only when project is ready for related work.

1.5 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum): If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 PRODUCTS

2.1 PLANTER MIX MATERIAL.

A. Prepared Planting Mix for Shade and Ornamental Trees: Contractor to use the specified prepared planting mix for use in backfilling all shade and ornamental trees and shall consist of the following<update as necessary>

1. Three (3) parts native soil. *Existing native soil shall be fertile, friable, free of clay lumps, weeds, non-soil materials, litter, high sodium, contamination, roots, stumps, and stones larger than 1" in size, and other deleterious materials. PH value shall be between 6.0 and 7.0.*
2. One (1) part Composted Bark Mulch
   a. Contents: Bark, leaves, and Manure
   b. Process: Contents are hammer-milled through1-1/2" screen, blended and composted. Materials are composted aerobically.
   c. Temperatures shall be sustained to 165 degrees F to kill all seeds, insects and pathogenic bacteria. Initial PH to be in the 6.3 to 6.9 range
3. Mix 1 part Schultz® Multi-Purpose Soil Conditioner™ with 4 parts native soil
4. Chemical additives for PH adjustment as required by soils test as listed in items D through F below
5. Commercial fertilizers and additives as listed in item C below.

B. Prepared Planting Mix for Shrubs, Ground Covers, and Perennials/Annuals: Contractor to use the specified prepared planting mix for use in backfilling all shrubs, ground covers, perennials, and annuals and shall consist of the following

1. One (1) part Composted Bark Mulch
   a. Contents: Bark, leaves, and Manure
   b. Process: Contents are hammer-milled through1-1/2" screen, blended and composted. Materials are composted aerobically.
   c. Temperatures shall be sustained to 165 degrees F to kill all seeds, insects and pathogenic bacteria. Initial PH to be in the 6.3 to 6.9 range.
2. One (1) part Enriched Top Soil
3. One (1) part Enriched Mulch
   a. Materials to be processed in the same manure as composted bark mulch but with a greater percent of manure.
4. One (1) part #1 Bank Sand.
5. Chemical additives for PH adjustment as required by soils test as listed in items D through F below
6. Commercial fertilizers and additives as listed in item C below.

C. Commercial Fertilizers and additives
   1. Shall be a complete organic or naturally occurring fertilizer, part of the element of which is derived from organic sources. Fertilizers shall be comprised of water soluble and controlled release per manufacturer's recommendations. It shall be the type percentages and applied at the rate specified in the soil analysis. The percentage of Nitrogen derived from non-organic (i.e. synthetic sources such as Urea and Ammonium nitrate) sources shall not exceed 50% of the stated Nitrogen content of the fertilizer.
   2. Fertilizer package shall also include at a minimum, Humates, Bio-inoculants, Bio-stimulants, micro nutrients and other pre-approved ingredients that promote soil health and microbial activity.
   3. Fertilizer shall be delivered mixed as specified in standard size bags, showing weight, analysis and name of manufacturer, and shall be stored in a weatherproof storage place, and in such a manner that it will be kept dry and it's effectiveness will not be impaired. Fertilizers shall be thoroughly mixed into the soil, broadcast and tablet forms are not acceptable.
   4. Application Rates: Per approved by manufacturer based upon an entire plant mix application rate per cubic yard. Contractor to supply manufacturer product data sheet indicated recommended application rates prior to purchasing and mixing fertilizer.
   5. Approved fertilizer Product and Supplier:
      Microlife 'Ultimate' (8-4-6), 25 lbs per cubic yard application rate thoroughly mixed into the planter mix. Contractor shall not mix fertilizer on-site.
      San Jacinto Environmental Supplies
      Attention: Greg Cooper
      Houston, Texas
      (713) 957-0909.

D. Planting Mix PH Level: PH levels shall be between 6.3 and 6.9. Contract shall chemically adjust the PH level as necessary to achieve the required PH level. Contract to provide specifications for adjusting the PH level for approval by Owner's representative.

E. Soil Additives: (If required by soils tests).
   1. Iron sulfate (Ferric or Ferrous): Shall contain 30 to 35% iron, 35-40% sulfur and be supplied by a commercial fertilizer supplier.
   2. Treble Super phosphate: Commercial product containing 19 to 20% available phosphoric acid.
   3. Urea Formaldehyde: Commercial product containing 38% Nitrogen.
   4. Soil Sulfur: Agricultural grade sulfur containing a minimum of 96% sulfur.
   5. Ammonium Sulfate: Commercial product containing approximately 21% ammonia.

F. Hardwood Bark Mulch Topdressing: Organic mulch free from deleterious materials and suitable for top dressing of trees and planting bed areas. Mulch shall be composted, well rotted shredded hardwood bark mulch, brown in color.

2.2 PLANTING MIX PREPARATION

A. Shall be thoroughly mixed in the following proportions:

B. Prepared backfill mixes shall come from an approved source.

C. Contractor can use on-site soil for preparation of backfill mix for shade and ornamental trees.

PART 3 EXECUTION

3.1 MIXING

A. Mix soil base, amendments and chemical additives by mechanical means. Do not mix additives with excavated material at the plant pit site.

B. Thoroughly mix all amendments with soil by mechanical means.

C. Soil and sand bases shall be completely pulverized and free of lumps or aggregated material. Moisture content of base materials shall not be such that chemical, granular or pelletized additives become dissolved during the mixing process.

D. Mix media in quantities of not less than 50 cubic yards or mix total quantity required, if less than 100 cubic yards. The Contractor shall be responsible for continuity between batches.

E. For soil media mixes do not incorporate soil from mixing area with mix unless approved by Owner's Representative or Landscape Architect.

END OF SECTION

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SECTION 32 94 50

GENERAL USE COMPOST

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section consists of the requirements for furnishing all materials, labor, equipment, supplies, supervision, and tools, and performing all work necessary to place erosion control compost as shown on the plans.

1.2 RELATED SECTIONS

A. Section 329119 - Landscape Grading
B. Section 329400 - Planting Mix
C. Section 329350 - Planting
D. Section 320190 - Landscape Grounds Maintenance

1.3 REFERENCES

A. Meet, or exceed, the requirements of the United States Composting Council (USCC) Seal of Testing Assurance (STA) program.

1.4 SUBMITTALS

A. The feedstock by percentage in the final compost product,
B. A statement that the compost meets federal and state health and safety regulations,
C. A statement that the composting process has met time and temperature requirements,
D. A copy of the producer's STA certification, and
E. A copy of the lab analysis, performed by an STA-certified lab, verifying that the compost meets the requirements of Table 1.
F. When furnishing biosolids compost, also provide a copy of the current TCEQ compliance statement signed by the facility manager.

1.5 TESTING

A. Testing shall be conducted and prepared by the following testing laboratory or approved equal testing service:
   Soil Food Web
   35 SW Western Blvd.
   Corvallis, OR 97333
   phone: 541-752-5066
   info@oregonfoodweb.com
B. Provide Full Food Web including mycorrhizal colonization.
C. Alternative testing services must demonstrate a similar testing process to that provided by the Soil Food Web.
D. Provide a designated project stockpile of unblended compost for sampling and testing at the producer's site. The Contractor shall take samples from each stockpile for quality

assurance (QA). Make payment to the STA-certified lab approved by the Authority for the required QA testing.

1) Submit lab invoices for passing QA tests to the Authority for reimbursement unless included within the project Allowance
2) Maintain compost in designated stockpiles at the producer's site until accepted by the Authority's Representative. The Authority's Representative reserves the right to sample compost at the jobsite.

1.6 PRODUCT HANDLING

A. Seed Delivery- Each variety of seed shall be delivered in separate bags or containers, labeled to indicate pure live seed, name and type of seed.

B. Fertilizer Delivery- Fertilizer shall be delivered in the manufacturer's unopened containers, labeled to indicate the manufacturer's name and product identification.

1.7 TIMING OF WORK AND STORAGE

A. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

B. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.

C. Store products with protection from weather or other conditions which would damage or impair the effectiveness of the product.

1.8 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment shall be made for general use compost used in prepared planting mixes, include payment in other specific unit prices.

2. Payment for general use compost used as a topdressing for new or existing turf areas shall be paid for on a cubic yard basis and shall include, but is not limited to compost, transportation, testing, spreading, tilling, watering, and miscellaneous complete and in place.

3. No separate payment shall be made for excavation and disposal of waste materials needed prior to use of general use compost for turf areas.

4. No separate payment shall be made for required testing.

B. Stipulated Price (Lump Sum): The Contract is a Stipulated Price Contract, payment for labor, materials, and all miscellaneous costs required as part of the work required in this Section is included in the total Stipulated Price.

PART 2 - MATERIALS

2.1 MIX

A**.** Furnish compost that has been produced by aerobic (biological) decomposition of organic matter and meets the requirements of Table 1. Compost feedstock may include, but is not limited to, leaves and yard trimmings, biosolids, food scraps, food-processing residuals, manure or other agricultural residuals, forest residues, bark, and paper. Ensure compost and wood chips do not contain any visible refuse, other physical contaminants, or any substance considered harmful to plant growth. Do not use materials that have been treated with chemical preservatives as a compost feedstock or as wood chips. Do not use mixed municipal solid waste compost. Provide compost meeting all applicable 40 CFR 503 standards for Class A biosolids and TCEQ health and safety regulations as defined in the TAC, Chapter 332, including the time and temperature standards in Subchapter B, Part 23. Before delivery of the compost, provide quality control (QC) documentation that includes the following:

2.2 PHYSICAL REQUIREMENTS OF COMPOST

A**.** Furnish compost that has been produced by aerobic (biological) decomposition of organic matter and meets the requirements of Table 1. Compost feedstock may include, but is not limited to, leaves and yard trimmings, biosolids, food scraps, food-processing residuals, manure

Table 1
Physical Requirements for Compost

Property	**Test Method**	**Requirement**
Particle Size	TMECC1 02.02-B, “Sample Sieving for Aggregate Size Classification”	95% passing 5/8 in. 70% passing 3/8 in.
Heavy Metals Content	TMECC 04.06, **“**Heavy Metals and Hazardous Elements”: 04.06-As, Arsenic 04.06-Cd, Cadmium 04.06-Cu, Copper 04.06-Pb, Lead 04.06-Hg, Mercury 04.06-Mo, Molybdenum 04.06-Ni, Nickel 04.06-Se, Selenium 04.06-Zn, Zinc	Pass
Soluble Salts	TMECC 04.10-A, “1:5 Slurry Method, Mass Basis”	5.0 dS/m maximum2

pH	TMECC 04.11-A, "1:5 Slurry pH"	5.5–8.5
Maturity	TMECC 05.05-A, "Germination and Root Elongation"	> 80%
Organic Matter Content	TMECC 05.07-A, "Loss-On-Ignition Organic Matter Method"	25–65% (dry mass)
Stability	TMECC 05.08-B, "Carbon Dioxide Evolution Rate"	8 or below
Fecal Coliform	TMECC 07.01-B, "Fecal Coliforms"	Pass

1. "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the USCC.
2. A soluble salt content up to 10.0 dS/m for compost used in compost manufactured topsoil will be acceptable.

2.3 COMPOST MIX, DESCRIPTION, AND PRODUCTION REQUIREMENTS

A. General use compost will consist of 100% compost.
B. Prepare the types of compost for use on the project and stockpile at the jobsite.
C. Apply compost in a uniform layer and incorporate into the existing in place topsoil to the depth shown on the plans.
D. Production Requirements:
   1. Handcrafted Humus Compost is made from only grass clippings, leaves, very light branches.
   2. Raw Materials aged and composted in the raw form.
   3. Raw Materials shall pass through a 1st grind with a 1.5" screen and placed in a windrow configuration after the first grind.
   4. Windrows shall be turned and temps are monitored daily.
   5. Screen final product.

2.4 APPROVED SUPPLIER

A. **Nature's Way Resources Native (3/8" screened compost)**
101 Sherbrook Circle, Conroe, Texas 77385
(936) 321- 6990 Houston Metro
(936) 273-1200 Conroe/Montgomery County
(936) 273-1655 Fax

B. **The Ground Up, Northwest**
9945 Windfern Rd.
Houston, TX 77064
P: (281) 970-0003
F: (281) 955-1911

C . **Landscape Depot**
8901 FM 1960 Rd W
Houston, TX 77070-5519
P: (281) 890-0365

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work. Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.

B. Report in writing to the Landscape Architect the prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to Authority

3.2 USE OF COMPOST IN MULCH MIX

A. Incorporate compost into required mulch mix at the specified rates.
B. Mix thoroughly

3.3 FERTILIZATION

A. Apply fertilizer evenly over the site at the specified rate.
B. Incorporate into compost/soil with approved device.
C. Fertilizer prior to drill seeding.

3.4 COMPOST TOP DRESSING OF NEW OR EXISTING TURF

A. All areas within this contract not disturbed by construction or where repair of grade is not required shall be hydromulched or resodded in accordance with the Contract Drawings and other related specification sections.

B. All disturbed areas shall be fine graded prior to hydromulching and solid sodding.

C. Spread 2” of general use compost over area to be sodded or hydromulched. Till into top 6” of existing soil. Remove any debris, gravel, or deleterious material prior to sodding or hydromulching. Water in thoroughly to allow for settling of.

END OF SECTION

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SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Drains.
3. Encasement for piping.
4. Manholes.
5. Stormwater inlets.

1.2 DEFINITIONS

A. PVC – Polyvinyl Chlorine

B. RCP – Reinforced Concrete Pipe

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type pipe and fitting, from manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. Corrugated profile-wall smooth limed pipe for gravity storm sewer and storm sewer culvert pipe per ASTM 3350 manufactured per ASTM 2306, Joints shall be installed such that connection of pipe sections will form continuous line free irregularities in flow line. Suitable joints are:

1. Integral Bell and spigot. Bell shall overlap minimum of two corrugations of spigot and when fully engaged.
2. Exterior bell and Spigot. Bell shall be fully welded exterior of pipe and overlap spigot end so that flow lines and ends match when fully engaged.
3. Gaskets: Meet requirements of ASTM F 477. Use gasket modeled into circular form or extruded to proper section and then spiced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Bell-and-spigot ends and gasketed joints with ASTM C 443 rubber gasket
2. Class III.

2.4 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.5 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990 bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: As Indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

D. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate with short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install inlets or junction boxes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install inlets or junction boxes different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping minimum cover as indicated.
3. Install HDPE corrugated sewer piping according to ASTM D 2321.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
3. Join dissimilar pipe materials with structures.

3.4 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, according to piping manufacturer's written instructions.

3.6 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least below final grade. Fill to within of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 312000 "Earth Moving."

3.7 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping according to ASTM F 1417.
c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION