

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

## FOR:

East Aldine Town Center  
Infrastructure Package  
3314 Aldine Mail Route, Houston, Texas 77039  
UPIN: 17035MF0M201  
East Aldine Management District  
Precinct 2

### 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://bids.hctx.net/bs/>. The items include:

- Pricing/Delivery Information
- Scope of Work
- Special Provision to Standard Specifications
- Special Specifications
- Supplement to General Requirements
- Contract Time



## SCOPE OF WORK

East Aldine Town Center Sec 1 Infrastructure Package includes the construction of concrete roadways, utility infrastructure, a wet basin, channel reconstruction, site landscaping, and site grading. The total area of the 61.57-acre site that will be disturbed during construction is 19.30-acres plus an additional 1.05-acres of offsite area that includes the EAMD and HCFCO P118-37-00 channels.

Approximately 13,930 SY of concrete pavement for roadways will be constructed that will also include pavers to be placed at select locations in the roadways and at all crosswalks. Non-standard streetlights will be located alongside all roadways and the wet basin as specified in the plans. A precast arch retaining wall is to be located next to the wet basin under and alongside one of the proposed roadways.

The reconstruction of HCFCO P118-37-00 includes the addition of an offsite ditch interceptor structure, a typical interceptor structure, backslope swale, and pipe outfall replacement and adjustments. Concrete riprap shall be placed at specified locations to reduce erosion.

The areas between the back-of-curb and landscape reserve easement will be sodded and graded up at a 3:1 maximum slope, allowing sidewalks to be a maximum of 2% slope and driveways to be less than 12%.

This project includes a Storm Water Quality Management Plan (SWQMP) and a Storm Water Pollution Prevention Plan (SWPPP).

All work shall be performed in accordance with the attached drawings and specifications.

Any Access Roads to adjacent construction sites that are damaged during the construction of this project will have to be repaired, or alternate access to their sites provided.

Power Conduits identified will need to be provided to the 911 Call Center site by 01 November 2017.  
Storm Water connections to the 911 will need to be provided by 01 November 2017.

## 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.

**NOTICE TO CONTRACTORS**  
**TPDES CONSTRUCTION GENERAL PERMIT**  
**NOTICE OF INTENT (NOI) FORMS AND FEES**  
**FOR SITES THAT MEET THE DEFINITION OF PART II.E.3**  
**(LARGE CONSTRUCTION ACTIVITIES)**

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. The Contractor, as primary operator as defined by the TPDES General Permit, shall certify one NOI. The certified NOI, a check or money order (made payable to TCEQ) for the TPDES General Permit TXR150000 NOI Application Fee, and a completed Texas Commission on Environmental Quality (TCEQ) General Permit Payment Submittal Form shall be provided by the Contractor to Harris County at the Preconstruction Meeting (the Contractor has the option to submit the Contractor's NOI form and fee electronically to the TCEQ. If submitted electronically, then the Contractor shall provide copies of the electronic submittal to Harris County at the Preconstruction Meeting).

Additionally, the Contractor shall provide a check payable to TCEQ in the amount of \$325 for Harris County's NOI Application Fee. This check must be mailed and or delivered to Harris County Construction Programs Division **Attn. Suzette Moody-Johnson** (1310 Prairie, Suite 1105, Houston , TX 77002) prior to the Preconstruction Meeting. After the Preconstruction Meeting, Harris County shall mail the certified NOI(s), check(s), and the Payment Submittal Form(s) to the TCEQ. Please note, the County's fee cannot be paid online. **CONTRACTOR WILL NOT BE ALLOWED TO SIGN THE PURCHASE ORDER UNTIL HARRIS COUNTY RECIEVES THE CHECK.**

NOTICE TO CONTRACTORS  
BIDDING TRAFFIC SIGNAL INSTALLATIONS

To ensure completion of the project within the specified time, acquisition and accumulation of needed materials (poles, signal heads, controllers, cabinets and detector amplifiers) should begin upon receipt of purchase order from Harris County. The Contractor shall commence work immediately upon receipt of materials.

The Contractor shall be required to provide Harris County a copy of their purchase order(s) to supplier(s) for all material(s) ordered along with acknowledgement from the supplier and projected delivery date.

The date of commencement shall be at Harris County's discretion subject to availability of materials. The Contractor shall be allowed not more than 15 calendar days for initial submittal of shop drawings and not more than 10 calendar days for each submittal during the job that requires shop drawings.

The Contractor shall notify Harris County 48 hours prior to the turn-on of the traffic signal system.

The Final payment to the Contractor will be based upon the final inspection approval that the signal system was installed in accordance with the drawings and specifications, and has successfully undergone the field test to Harris County's satisfaction (See Item 1000, "Traffic Signal Installation and Modification").

## NOTICE OF SPECIFICATIONS

For the construction of this project, the Contractor shall use the attached Special Provisions, Special Specifications, and the Specification Book - SPECIFICATIONS FOR THE CONSTRUCTION OF ROADS AND BRIDGES WITHIN HARRIS COUNTY, TEXAS, dated April 1988, with revisions through May 1, 2016.

The current specifications may be found at the Harris County Engineering Department (HCED) website [www.eng.hctx.net](http://www.eng.hctx.net).

When applicable and/or as noted, the Contractor shall use the Harris County Flood Control District (HCFCD) 2005 Standard Specifications Book. The current HCFCD specifications may be found at the HCFCD website:  
[https://www.hcfcd.org/media/1311/hcfcd\\_2005\\_specifications.pdf](https://www.hcfcd.org/media/1311/hcfcd_2005_specifications.pdf).

When applicable and/or as noted for potable water and sanitary sewer systems, the Contractor shall also use the City of Houston's Standard Specifications. The current specifications may be found at the City of Houston website  
<http://edocs.publicworks.houstontx.gov/engineering-and-construction/specifications.html>



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## SECTION 044300 - STONE MASONRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes the following applications of stone masonry:

1. Anchored to concrete backup.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1. For stone varieties proposed for use on Project, include test data indicating compliance with physical properties required by referenced ASTM standards.

- B. Samples:

1. Submit 3 samples not less than 8 inches X 12 inches (0.2 m X 0.3 m) in size of the color, grade and finish of flagstone required. Include in each set the full range of exposed color and texture to be expected in the completed work. Review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
2. Sample shall be cut from same block as proposed for project. Objectionable variation in color, graining or irregularities, as determined by Landscape Architect, will be cause for rejections.
3. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.
  - a. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 24 inches high.

#### 1.3 PROJECT CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried.

- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 LIMESTONE

- A. Limestone: Comply with ASTM C 568.

### 2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

- B. Hydrated Lime: ASTM C 207, Type S.

- C. Masonry Cement: ASTM C 91.

- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in stone masonry mortar.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Davis Colors; True Tone Mortar Colors.
    - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
    - c. Solomon Colors; SGS Mortar Colors.
    - d. As approved by Owner's Representative.

- E. Colored Cement Product: Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

- 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  - 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Colored Portland Cement-Lime Mix:

- 1) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
      - 2) Lafarge North America; Eaglebond.
      - 3) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
      - 4) As approved by Owner's Representative.

- b. Colored Masonry Cement:

- 1) Essroc, Italcementi Group; Brixment-in-Color.

- 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
- 3) Lafarge North America.
- 4) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
- 5) As approved by Owner's Representative.

F. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
2. White Aggregates: Natural white sand or ground white stone.
3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

G. Latex Additive: water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Boiardi Products Corporation.
  - b. Bonsal.
  - c. Bostik Findley Inc.
  - d. C-Cure.
  - e. Custom Building Products.
  - f. DAP Inc.
  - g. Laticrete International, Inc.
  - h. MAPEI Corp.
  - i. Summitville Tiles, Inc.
  - j. TEC Specialty Construction Brands; H. B. Fuller Company.
  - k. As approved by Owner's Representative.

H. Water: Potable.

## 2.3 VENEER ANCHORS

A. Materials:

1. Hot-Dip Galvanized-Steel Wire: ASTM A 82, with ASTM A 153/A 153M, Class B-2.
2. Stainless-Steel Wire: ASTM A 580/A 580M.
3. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008/A 1008M, cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M, Class B-2.
4. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch-diameter, hot-dip galvanized-steel wire.

- C. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Dur-O-Wal, a Dayton Superior Company.
    - b. Heckmann Building Products Inc.; 315-D with 316.
    - c. Hohmann & Barnard, Inc..
    - d. Wire-Bond.
    - e. As approved by Owner's Representative.
  2. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.
  3. Anchor Section: Sheet metal plate, with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for inserting wire tie.
  4. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch-thick, steel sheet, galvanized after fabrication.
  5. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized-steel wire.
- D. Seismic Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dur-O-Wal, a Dayton Superior Company; D/A 213S.
    - b. Hohmann & Barnard, Inc.; DW-10-X-Seismiclip.
    - c. Wire-Bond; RJ-711 with Wire-Bond Clip.
    - d. As approved by Owner's Representative.
  2. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch.
  3. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
  4. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire.
  5. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch-thick, steel sheet, galvanized after fabrication.
  6. Fabricate wire connector sections from 0.188-inch-diameter, hot-dip galvanized, carbon-steel wire.
  7. Continuous Wire: 0.188-inch-diameter, hot-dip galvanized-steel wire.

## 2.4 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with" and as follows:
1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
  2. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. weight or 0.0135 inch thick for fully concealed flashing; 16-oz./sq. ft. weight or 0.0216 inch thick elsewhere.
- B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Advanced Building Products Inc.; Copper Fabric Flashing.
      - 2) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
      - 3) Phoenix Building Products; Type FCC-Fabric Covered Copper.
      - 4) Polytite Manufacturing Corporation; Copper Fabric Flashing.
      - 5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
      - 6) York Manufacturing, Inc.; York Copper Fabric Flashing.
      - 7) As approved by Owner's Representative.
  2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Advanced Building Products Inc.; Peel-N-Seal.
      - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      - 3) Dur-O-Wal, a Dayton Superior Company; Dur-O-Barrier-44.
      - 4) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
      - 5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
      - 6) Hohmann & Barnard, Inc.; Textroflash.
      - 7) Polyguard Products, Inc.; Polyguard 300.
      - 8) Polytite Manufacturing Corporation; Poly-Barrier Self-Adhering Wall Flashing.
      - 9) Williams Products, Inc.; Everlastic MF-40.
      - 10) As approved by Owner's Representative.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Cementitious Dampproofing: Cementitious formulations that are recommended by ILI and that are nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
- B. Weep Hole/Vent Products: Use one of the following unless otherwise indicated:
  - 1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity behind stone masonry. Use only for weep holes.
  - 2. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch OD by thickness of stone masonry.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  - 1. Provide one of the following configurations:
    - a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep.
    - b. Strips, not less than 3/4 inch thick and 10 inches wide, with dimpled surface designed to catch mortar droppings.
    - c. Sheets or strips full depth of cavity and installed to full height of cavity.
    - d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity.
  - 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Advanced Building Products Inc.; Mortar Break II.
    - b. CavClear/Archovations, Inc.; CavClear Masonry Mat.
    - c. Dur-O-Wal, a Dayton Superior Company; Polytite MortarStop.
    - d. Mortar Net USA, Ltd.; Mortar Net.
    - e. As approved by Owner's Representative.
- D. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).
- E. Welded-Wire Lath: ASTM C 933, fabricated into 2-by-2-inch mesh with minimum 0.0625-inch-diameter, galvanized-steel wire.
- F. Cavity-Wall Insulation: Extruded-polystyrene board insulation, ASTM C 578, Type IV.
- G. Cavity-Wall Insulation: Polyisocyanurate board insulation, ASTM C 1289, Type I (aluminum-foil faced), Class 2 (glass-fiber reinforced).

## 2.6 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Diedrich Technologies, Inc.
    - b. Dominion Restoration Products.
    - c. EaCo Chem, Inc.
    - d. Hydrochemical Techniques, Inc.
    - e. Prosoco, Inc.
    - f. As approved by Owner's Representative.

## 2.7 MORTAR MIXES

- A. General: Do not use admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride.
  - 2. Limit cementitious materials in mortar to portland cement and lime.
  - 3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.
  - 1. Mortar for Setting Stone: Type N.
  - 2. Mortar for Pointing Stone: Type N.
- C. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
- D. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
  - 1. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
- E. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
- F. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.



- G. Pigmented Mortar: Use colored cement product.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Pigments shall not exceed 5 percent of masonry cement by weight.

## 2.8 FABRICATION

- A. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.
- B. Gage backs of stones for adhered veneer if more than 81 sq. in. in area.
- C. Shape stone for type of masonry (pattern) as noted in drawings.
- D. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
- B. Coat concrete and unit masonry backup with asphalt dampproofing.

### 3.2 SETTING OF STONE MASONRY, GENERAL

- A. Perform necessary field cutting and trimming as stone is set.
  - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces.
  - 2. Use hammer and chisel to split stone that is fabricated with split surfaces.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in range ashlar pattern with course heights as indicated, uniform lengths, and uniform joint widths, with offset between vertical joints as indicated.
- D. Arrange stones in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.
- E. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

- F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 3/8 inch at widest points.
- G. Provide sealant joints of widths and at locations indicated.
  - 1. Keep sealant joints free of mortar and other rigid materials.
- H. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
  - 1. At concrete backing, extend flashing through stone masonry, turned up a minimum of 6 inches, and insert in reglet.
  - 2. At ends of head and sill flashing turn up not less than 2 inches to form end dams.
  - 3. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.
  - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  - 5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
  - 6. Cut flexible flashing flush with face of wall after masonry wall construction is completed.
- I. Coat limestone with cementitious dampproofing as follows:
  - 1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.
  - 2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
- J. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
  - 1. Use open head joints to form weep holes.
  - 2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
  - 3. Space weep holes 24 inches o.c.
  - 4. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.
  - 5. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- K. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated.

### 3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control

joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

### 3.4 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.
- B. Anchor stone masonry to unit masonry with corrugated-metal or individual wire veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells for distance at least one-half of unit masonry thickness.
- C. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.
- D. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry joint reinforcement projecting from unit masonry.
- E. Anchor stone masonry to stud framing with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with two screws.
- F. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least 5/8-inch cover on outside face.
  - 1. Install continuous wire reinforcement in horizontal joints and attach to seismic veneer anchors as stone is set.
- G. Space anchors to provide not less than 1 anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- H. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- I. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- J. Fill space between back of stone masonry and weather-resistant sheathing paper with mortar as stone is set.

- K. Provide 1-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
  - 1. Place mortar spots in cavity at veneer anchors to maintain spacing.
  - 2. Slope beds toward cavity to minimize mortar protrusions into cavity.
- L. Rake out joints for pointing with mortar to depth of not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

### 3.5 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
  - 5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
  - 6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 7. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

### 3.6 EXCESS MATERIALS AND WASTE

- A. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
  - 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

END OF SECTION 044300

## SECTION 129300 - SITE FURNISHINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

This Section includes the following:

1. Seating.
2. Tables.
3. Trash receptacles.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed finish.
- C. Material Certificates: For site furnishings, signed by manufacturers.
- D. Maintenance Data.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Refer to equipment list on drawings for all site furnishings, materials, finishes, colors, etc.
- B. Sleeves – ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine subgrades, finished surfaces and installation conditions. Do not start site furnishings work until unsatisfactory conditions are corrected.

#### 3.2 LOCATION AND INSTALLATION

- A. All locations shall be staked by Contractor and approved by Owner's representative prior to commencement of work. Location shall be as indicated on drawings.

- B. Install landscape furnishings as per manufacturer's instructions. The manufacturer's instructions shall be considered a part of these Specifications. Installation contractor shall be a contractor approved by manufacturer for installation of manufacturer's equipment.
- C. All areas surrounding locations of landscape accessories shall be minimally disturbed. Contractor shall re-grade and repair areas and return site and improvements to original condition.
- D. Contractor to confirm all fall zone requirements prior to installing equipment. Immediately notify the Owner's Representative of any discrepancies.

### 3.3 INSTALLATION

- A. Site Furniture
  - 1. Assemble sections per manufacturer's recommendations.
  - 2. Install level and plumb. Shim as required to obtain an unyielding surface.
  - 3. Touch up all abraded, welded and scratched surfaces with matching rust inhibitive paint supplied by manufacturer.

## PART 4 – COMPLETION

### 4.1 CLEAN-UP

- A. The Contractor shall clean the site daily from trash and debris resulting from construction operations at no additional cost to Owner. All walks, roads and circulation routes shall be kept clean and free from debris, material and equipment.
- B. Upon completion of the work covered by this section, the Contractor shall clean up all areas by removing spoil piles, surplus material and equipment from the site. The ground surface shall be restored to its original condition.

END OF SECTION 129300

## SECTION 260200 - BASIC MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Tests
- B. Inspections
- C. Submittals
- D. Project Coordination

#### 1.2 RELATED SECTIONS

- A. General Conditions
- B. Supplementary Conditions
- C. Division One

#### 1.3 COOPERATION WITH TRADES:

- A. Cooperation with trades of adjacent, related, or affected materials or operations, shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

#### 1.4 REFERENCES

- A. National Electrical Code (NEC)
- B. American Society for Testing and Materials (ASTM)
- C. Underwriter's Laboratories, Inc. (UL)
- D. Insulated Cable Engineer's Association (ICEA).
- E. National Electrical Manufacturer's Association (NEMA).
- F. Institute of Electrical and Electronic's Engineers (IEEE).
- G. American National Standards Institute (ANSI).
- H. National Fire Protection Association (NFPA).

- I. International Energy Conservation Code (IECC).

#### 1.5 COMPLETE FUNCTIONING OF WORK:

- A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.
- B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.
  - 1. Approximate location of transformers, feeders, branch circuits, outlets, lighting panels, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
  - 2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, etc.) location about which there may be the least question.

#### 1.6 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

- A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

#### 1.7 DATE OF FINAL ACCEPTANCE

- A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.
- B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.
- C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.



## 1.9 SUBMITTALS

- A. Coordinate with Division 1 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or mylar in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:
1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
  2. An index page with a listing of all data included in the Submittal.
  3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
  4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
  5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
  6. Identification of each item of material or equipment matching that indicated on the Drawings.
  7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
  8. Additional information as required in other Sections of this Division.
  9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "**REVISE AND RESUBMIT**".
- B. Refer to Division 1 for additional information on shop drawings and submittals.

- C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.
- D. Where shop drawings and submittals are marked "**REVIEWED**", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.
- E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
1. **REVIEWED:** Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
  2. **REVIEWED AS NOTED:** Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
  3. **NOT APPROVED:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
  4. **REVISE AND RESUBMIT:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
  5. **CONTRACTOR'S CERTIFICATION REQUIRED:** Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
  6. **MANUFACTURER NOT AS SPECIFIED:** Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.
- F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.
- G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

- H. Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:
  - Panelboards
  - Heavy Duty Disconnect Switches
  - Transformers
  - Lighting Fixtures
  - Lighting Contactors
  - Time Clocks
  - Photocells
  - Wiring Devices and Plates
  - Conduit and Fittings
  - Wire
- I. Refer to each specification section for additional requirements.

#### 1.10 OPERATION AND MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:
  - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
  - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  - 4. Servicing instructions and lubrication charts and schedules.

#### 1.11 RECORD DRAWINGS

- A. Maintain a continuous record during the course of construction of all changes and deviations in the work from the contract drawings. Upon completion of the work, purchase a set of "Auto Positive Tracings" on vellum and make corrections as required to reflect the electrical systems as installed. Location and size of all conduit shall be accurately shown to dimension. Submit three prints of the tracings for approval. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. Record drawings shall be furnished in addition to shop drawings. Symbols on the Record drawings shall correspond to the identification symbols on the contract drawings and equipment identification plates and tags.
- B. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.
- C. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproduces is a condition of final acceptance.

- D. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.
- E. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.
- F. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: \_\_\_\_\_  
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: \_\_\_\_\_  
(SIGNATURE)

1.12 CERTIFICATIONS AND TEST REPORTS

- A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.
- B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.
- C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.
- D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

### 1.13 MAINTENANCE MANUALS

- A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.
  
- B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26, include the following information for equipment items:
  - 1. Identifying names, name tags designations and locations for all equipment.
  - 2. Reviewed shop drawing submittals with exceptions noted compliance letter.
  - 3. Fabrication drawings.
  - 4. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
  - 5. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions.
  - 6. Maintenance procedures for routine preventative maintenance and troubleshooting.
  - 7. Equipment name plate data.
  - 8. Wiring diagrams.
  - 9. Exploded parts views and parts lists for all equipment and devices.
  - 10. Color coding charts for all painted equipment and conduit.
  - 11. Location and listing of all spare parts and special keys and tools furnished to the Owner.
  
- C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.
  
- D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

### 1.14 OPERATOR TRAINING

- A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 4 hours of site training.
  
- B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

- C. Refer to other Division 26 Sections for additional Operator Training requirements.

#### 1.15 SITE VISITATION

- A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.
- B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.
- C. Understand the new and existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.
- D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

#### 1.16 WARRANTY

- A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

#### 1.17 TRANSFER OF ELECTRONIC FILES

- A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.
- B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

- C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.
- D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.
- E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

If the client, Architect/Owner, or developer of the project requires electronic media for "record purposes", then an AutoCAD based compact disc ("CD") will be prepared. The "CD" will be submitted with all title block references intact and will be formatted in a "plot" format to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

- F. At the Architect/Owner's request, Engineer will prepare one "CD" of electronic media to assist the contractor in the preparation of submittals. The Engineer will prepare and submit the "CD" to the Architect/Owner for distribution to the contractor. All copies of the "CD" will be reproduced for a cost of reproduction fee of Five Hundred Dollars (\$500.00) per "CD".

The "CD" will be prepared and all title blocks, names and dates will be removed. The "CD" will be prepared in a ".dwg" format to permit the end user to revise the drawings.

- G. This Five Hundred Dollars (\$500.00) per "CD" cost of reproduction will be paid directly from the Contractor to the Engineer. The "CD" will be prepared only after receipt of the Five Hundred Dollars (\$500.00). The Five Hundred Dollars (\$500.00) per "CD" cost of reproduction is to only recover the cost of the manhours necessary to reproduce the documents. It is not a contractual agreement between the Contractor and Engineer to provide any engineering services, nor any other service.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
  2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
  3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.
- B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.
- 2.2 All materials and products used on this project shall be listed by Underwriters' Laboratories.
- 2.3 EQUIPMENT PADS
- A. Unless noted otherwise 4" high concrete pads for floor mounted equipment shall be installed under Division 3. Pads shall conform to the shape of the equipment with a minimum of 3" margin at equipment supports. Top and sides of pads shall be troweled to a smooth finish, equal to floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.
- 2.4 SPACE LIMITATIONS
- A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.
- 2.5 PAINTING
- A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.
- 2.6 ELECTRICAL SYSTEM IDENTIFICATION
- A. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.
- B. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's



- address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way.
2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each panel contactor and timeclock.
    - a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:
      - 1) Name
      - 2) Voltage
      - 3) Phase
      - 4) “3” or “4” wire, and
      - 5) Where it is fed from.
    - b. An example of a panelboard nameplate is:  
Center Panel – RR  
208Y/120 volt, 3 phase, 4 wire  
Center Fed from service transformer.
  3. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each safety switch, disconnect switch, enclosed circuit breaker, wireway, and terminal cabinet.
    - a. Identifying nameplates shall have ¼ inch high engraved letters and shall indicate the equipment served.
    - b. An example if a disconnect switch is: Irrigation controller.
  4. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit.
  5. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters’ Laboratories, Inc.), and approval labels are exceptions to this requirement.
  6. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
  7. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: “DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING.”

### PART 3 - EXECUTION

#### 3.1 EXCAVATING AND BACKFILLING

- A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall

be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3” of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. **All work shall comply with OSHA Standards.**

### 3.2 WORKMANSHIP AND CONCEALMENT

- A. The work of this Section shall be performed by workman skilled in their trade.

### 3.3 ELECTRICAL GEAR

- A. Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.
- B. Lighting contractors, time clocks, panels, etc. mounted in enclosures shall be mounted at a working height. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each enclosure, noting locations and mounting heights of all electrical devices shown to be installed. Sketches shall be provided to the Engineer for review, and the general contractor for coordination with other trades.

### 3.4 CLEANING

- A. Clean lighting fixtures and equipment.
- B. Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

### 3.5 TESTS AND INSPECTIONS

- A. Tests and inspection requirements shall be coordinated with Division I.
- B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.
- C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.
- D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

- E. Final Inspection:
1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
  2. Panelboards, switches, fixtures, etc., shall be cleaned and in operating condition.
  3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
  4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
  5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

END OF SECTION 260200

SECTION 260519 - WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.1 SCOPE

- A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.
- B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.
  - 1. Wiring for lighting and power.
  - 2. Automatic Control Wiring.
  - 3. Connection of equipment shown.
- C. WORK SPECIFIED ELSEWHERE:
  - 1. Heating, ventilating, and air conditioning equipment.
  - 2. Structured cabling system.
  - 3. Coaxial cables

1.2 STANDARDS

- A. UL83
- B. ASTM B-3
- C. All wire cable and connectors shall be UL approved.

1.3 ACCEPTABLE MANUFACTURERS

- A. 600 VOLT WIRE AND CABLE
  - 1. Southwire
  - 2. General Cable
  - 3. Essex
  - 4. Cerro
  - 5. American Insulated Wire Corporation
- B. CONNECTORS
  - 1. AMP
  - 2. Burndy
  - 3. Ideal
  - 4. 3M
  - 5. O.Z. Gedney
  - 6. Thomas & Betts

1.4 SUBMITTALS

- A. Shop drawings shall include, but not limited to:
  - 1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

- A. National Electrical Code.
- B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 WIRING

- A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.
- B. WIRE MATERIAL: Soft drawn, annealed, 98% pure copper, with tin coating. Aluminum wiring is not acceptable.
- C. TYPES:
  - 1. Provide type “THHN/THWN” insulation for all buried feeders and service entrance conductors.
  - 2. Provide type “THHN/THWN” insulation for all branch circuits.
  - 3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.
- D. CONDUCTOR SIZES
  - 1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.
  - 2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.
  - 3. Minimum wire shall be No. 12, unless otherwise shown on Drawings or required by Code.
- E. COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:

<u>120/208 VOLT</u>	<u>277/480 VOLT</u>	<u>120/240 VOLT</u>
NEUTRAL: White	Neutral: Gray	Neutral: White
PHASE A: Black	Phase A: Brown	Phase A: Black
PHASE B: Red	Phase B: Purple	Phase B: Orange
PHASE C: Blue	Phase C: Yellow	Phase C: Blue
GROUND: Green	Ground: Green	Ground: Green

## 2.2 GROUNDING

Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with the National Electrical Code.

## PART 3 - EXECUTION

### 3.1 WIRE

- A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.
- B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.
- C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized wire nuts.
- D. All stranded conductors shall be furnished with lugs or connectors.
- E. Connectors furnished with circuit breakers shall be suitable for copper wire termination.
- F. "Sta-Cons" shall be used to terminate stranded conductors on all switches and receptacles.
- G. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.
- H. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

### 3.2 BALANCING SYSTEM

The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

### 3.3 DEFECTS

- A. Defects shall include, but are not to limited to, the following:
1. Tripping circuit breakers under normal operation.
  2. Improperly connected equipment.
  3. Damaged, torn, or skinned insulation.

END OF SECTION 260519

## SECTION 260526 - GROUNDING

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

#### 1.2 SCOPE

- A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:
  - 1. Electrical.
  - 2. Basic materials and methods.
- B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.
- C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

#### 1.3 STANDARDS

- A. NATIONAL ELECTRICAL CODE (NFPA-70)
- B. Local municipal and State codes that have jurisdiction.
- C. NECA

#### 1.4 ACCEPTABLE MANUFACTURES

- A. Provide grounding products manufactured by Copperweld and Cadweld.

#### 1.5 SUBMITTALS

- A. Shop drawings shall include, but not limited to the following:
  - 1. Cut sheets of ground rods, clamps and connectors.
  - 2. Grounding system diagram.



## PART 2 - PRODUCTS

- A. GENERAL: Provide all materials required to construct a complete grounded electrical system.
- B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.
- C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.
- D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.
- B. SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of each main panel.
- C. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.
- D. GROUNDING CONDUCTOR: A grounding conductor shall bond all equipment served by the electrical system.
- E. REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC.
- F. RECEPTACLES: All receptacle shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

- 3.2 TESTING: Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 OHMS. Provide additional electrodes as required (refer to 250-84 of the NEC or the most current edition 250-56). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION 260526

## SECTION 260533 - RACEWAYS

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide electrical raceways and fittings as shown, scheduled and specified.
- B. The types of raceways and fittings required are as follows:
  - 1. Rigid hot-dipped galvanized steel conduit (RGS)
  - 2. PVC
  - 3. Liquid-tight flexible metal conduit (non-metallic is not acceptable)
  - 4. PVC coated rigid galvanized steel conduit

#### 1.2 STANDARDS

- A. ANSI, C80.1 & C80.3
- B. NEMA FB-1
- C. NEMA TC3
- D. UL, 6, 797 & 1242

#### 1.3 ACCEPTABLE MANUFACTURERS

- A. Raceways
  - 1. Allied
  - 2. Triangle
  - 3. Republic
  - 3. Carlon
  - 4. Wheatland Tube
  - 5. Cantex
  - 6. Western Tube
- B. Fittings
  - 1. Appleton
  - 2. Crouse Hinds
  - 3. Steel City
  - 4. O.Z. Gedney
  - 5. Carlon
  - 6. Raco, Inc.

#### 1.4 SUBMITTALS

- A. Shop drawing shall include but not be limited to:
  - 1. Cutsheets for raceways and fitting.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

- A. National Electrical Code.
- B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 PROVIDE CONDUIT AS FOLLOWS:

- A. Except as noted or otherwise specified, all wiring shall be installed in PVC conduit of the proper size to contain the number of conductors required in accordance with the latest edition of the N.E.C. Where conduit sizes are shown on the drawings, these shall take preference.
- B. PVC coated rigid galvanized steel for underground use.
- C. Bear the stamped approval of the UL and be approved by the Architect and Engineer.
- D. Carlon Schedule 40 PVC may be utilized underground, in or below slab where shown on the construction documents.
- E. MINIMUM SIZE: 1 inch unless otherwise noted.
- F. PVC coated rigid galvanized steel conduit shall be coated inside and outside.

2.2 Branch circuits run underground shall be run in Carlon Schedule 40 PVC conduit. Install ground wire in accordance with NEC table 250-122.

2.3 FITTINGS

- A. PVC.
- B. Coupling and connectors accessories and fittings for PVC coated rigid galvanized steel shall be PVC coated.

PART 3 - EXECUTION

3.1 CONDUIT

A. GENERAL

The Drawings are diagrammatic, and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

- B. Of such size, and so installed that conductors may be drawn in without injury or excessive strain.
- C. Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.
- D. Have ends reamed after cutting and application of die.
- E. Keep conduit corked and dry during construction, and swab out before conductors are pulled.
- F. Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.
- G. Where not embedded in concrete or masonry, be firmly secured by approved clamps, half-straps or hangers.
- H. EXPANSION JOINTS: Make provision for expansion and shifting of metal or PVC conduits where risers occur from underground.
- I. Run conduit concealed, and by the shortest practicable route between lights.
- J. Conduits shall be continuous from outlet to outlet and from outlets to cabinets, junction or pull boxes and shall be electrically continuous throughout. Terminals of all conduits shall be provided with double lock nuts and bushing or terminated on conduit hubs. Use of running threads is prohibited.
- K. Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.
- L. All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.
- M. Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.
- N. When PVC conduit is routed underground, all stub-up's and 90° elbows shall be PVC coated rigid galvanized steel. Use PVC coated rigid galvanized steel when penetrating concrete on grade.
- O. Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

### 3.2 FITTINGS

- A. Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

### 3.3 CONDUIT CORROSION PROTECTION

- A. Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.
- B. At locations where metallic conduits pass through slabs on grade or transitions below grade, PVC coated rigid galvanized conduit shall be used.

### 3.4 OUTLET AND JUNCTION BOXES

- A. Provide an approved galvanized outlet box with adequate volume for number of conductors installed.
- B. Weatherproof boxes where necessary shall be FS or FD.
- C. Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.
- D. See notes and details on Drawings for special box requirements.

### 3.6 PULL BOXES

- A. Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code.
- B. Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

### 3.7 WIREWAYS

- A. Wireways shall be installed as indicated or required and locations shall be coordinated with architect.
- B. Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

- C. Wiring in wireways shall be neatly bundled, tied and suitably tagged.
- D. The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrodeposition paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

END OF SECTION 260533

## SECTION 262113 - LOW VOLTAGE UNDERGROUND ELECTRICAL POWERSYSTEMS

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. Power company fees shall be paid by Owner.

#### 1.2 SCOPE

- A. INCLUDED: Power Supply through main disconnect.
- B. RELATED WORK:
  - 1. Basic Electrical Materials and Methods.
  - 2. Earthwork Section.
- C. PRIMARY: Provide concrete encased primary conduits to meet power company standards from the terminal pole to the pad mounted transformer. Provide quantity and size required by power company. Conductors shall be installed by power company.
- D. TRANSFORMER PAD: Provide transformer concrete pad to meet power company standards.
- E. SECONDARY: Provide conduit and wire to meet capacity requirements noted on drawings.

#### 1.3 PERMITS, CODES, LAWS AND ORDINANCES

- A. NFPA-70, NESC, State and local.

#### 1.4 MINIMUM COMPLIANCE STANDARDS

### PART 2 – PRODUCTS

#### 2.1 ELECTRICAL SERVICE

- A. POWER SOURCE: [Entergy]
- B. SOURCE VOLTAGE: 480Y/277 volt, three phase, four wire system.

2.2 CABLE TERMINAL BOX

- A. Provide size as required.

2.3 METER PROVISIONS

- A. As required.

PART 3 - EXECUTION

3.1 SYSTEM ARRANGEMENT

- A. Underground service to main switchgear.

3.2 COORDINATION

- A. Confirm with power company exact locations of service entry and other requirements.

3.3 INSTALLATION

- A. Provide red concrete, conduit and wire.

END OF SECTION 262113



## SECTION 262213 - LOW VOLTAGE DISTRIBUTION TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide transformers as shown, scheduled and as specified.
- B. The type of transformers required includes dry-type general purpose transformers.

#### 1.2 STANDARDS

- A. Products shall be designed, manufactured, tested and installed in compliance with applicable IEEE, NEMA TPI-2002, NEMA ST1 and ST20, ANSI C33.4 and C89.2 standards.
- B. All low voltage transformers 15 kVA and larger shall meet or exceed post-January 1, 2016 U.S. DOE efficiency requirements [Energy, 10 C.F.R. §431.196(a)(2) (2015)] regardless of whether transformer date of manufacture is pre or post January 1, 2016. All low voltage transformers 15 kVA and larger shall be tested for efficiency in accordance with U.S. DOE test methods [Energy, 10 C.F.R. §431, Subpart K, Appendix A (2015)].

#### 1.3 ACCEPTABLE MANUFACTURERS

- A. Provide one of the following manufacturers for general purpose use:
  - 1. General Electric Company
  - 2. Square D Company
  - 3. Siemens
  - 4. Eaton

#### 1.4 SUBMITTALS

- A. Shop drawings shall include, but not be limited to:
  - 1. Cutsheets of transformers with sound and load ratings, dimensions, weights, impedance rating, insulation type, temperature rise and tap configurations.

#### 1.5 REQUIREMENTS OF REGULATORY AGENCIES

- A. National Electrical Code.
- B. Local, municipal, and/or state codes that have jurisdiction.

## PART 2 – PRODUCTS

### 2.1 GENERAL PURPOSE

- A. Provide dry type, two-winding transformers with primary and secondary voltages and KVA ratings as shown on plans. Transformers shall operate at 60 hertz. All transformers shall be manufacture with standard materials and components.

### 2.2 MATERIALS AND COMPONENTS FOR GENERAL PURPOSE TRANSFORMERS

- A. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall be isolated from the base by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating system requiring the complete removal of all fastening devices will not be accepted. Windings shall be copper or electrical grade aluminum terminated on tin plated or copper bars. Foil windings are not acceptable.
- B. The transformer core shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with NEMA, IEEE and ANSI standards.
- C. Transformer coils shall be of continuous-wound type construction and shall be impregnated with non-hygroscopic, thermo-setting varnish.
- D. Transformers shall be enclosed in drip-proof, metallic enclosures designed to provide for air cooling and prevent accidental contact with live conductors. Wiring compartment shall be located below the core and coil and cooled by air circulation or insulated from the core and coil by means of a suitable thermal insulation barrier. Transformer exposed to weather or installed in a sprinkled area shall have rain shields on all openings. Entire transformer enclosure shall be cleaned, phosphatized, primed and painted with a gray, baked enamel.
- E. Transformers shall operate at 100% nameplate KVA rating continuously while in a 40 degree C ambient without exceeding the rated average winding temperature rise of the ANSI insulation system as described below.

Temperature rating shall be as follows:

RATING	PHASE	INSULATION-TEMP. RISE
0.025 through 3 KVA	Single	Type B - 80° C
5 through 25 KVA	Single	Type F - 115° C
3 through 15 KVA	Three	Type F - 115° C
37½ KVA and larger	Single	Type H - 150° C
30 KVA and larger	Three	Type H - 150° C

F. Transformers shall have minimum full load rated taps in the primary windings as follows:

3 through 25 KVA	2 - 5% FCBN
15 through 300 KVA	6 - 2-½% TAPS, 2 above and 4 below normal

G. Maximum sound ratings shall be as follows:

KVA	db
0 to 9	40
10 to 50	45
51 to 150	50
151 to 300	55
301 to 500	60

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install transformer in accordance with manufacturer's written instructions, and recognized industry practices.
- B. Housekeeping Pad: Provide a nominal 3-½" high, 2500 PSI (28 Day) concrete reinforced pad with number 6 welded wire mesh. The pad shall conform to the shape of the transformer and extend at least 3 inches beyond the length and width of the transformer. All corners of the pad shall be rounded.
- C. Mounting: Install floor mounted transformers on properly sized rubber-in-shear vibration isolators. Trapeze mounted transformers shall use rubber-in-shear hangers. Wall mounted transformers shall not be mounted directly to the wall without vibration isolation.
- D. Connection: Route conductors in a minimum of 2 feet of flexible steel conduit to transformer enclosure. Provide grounding conductor sized per NEC, connected to the building grounding electrode system.

#### 3.2 TESTING

- A. Insulation, Tests: Prior to energization, check transformers windings for continuity and test the insulation resistance. Tests shall be made using a Biddle Megger or equivalent test instrument, per manufacturers recommendations. Provide written documentation of testing. Submit with O & M manuals.
- B. Tap Setting: Measure current and voltage under load conditions to provide correct tap settings.

END OF SECTION 262213

## SECTION 262416 - PANELBOARDS

### PART 1 - GENERAL

#### 3.1 SCOPE

- A. Provide panelboards as shown, scheduled and as specified herein.
- B. The types of panelboards include:
  - 1. Panelboards.
  - 2. Power distribution panelboards.

#### 3.2 STANDARDS

- A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.
- B. Products shall conform to all applicable UL standards and shall be UL-labeled.

#### 3.3 ACCEPTABLE MANUFACTURERS

- A. Provide one of the following manufacturers:
  - 1. General Electric Company
  - 2. Square D Company
  - 3. Siemens
  - 4. Eaton

#### 3.4 SUBMITTALS

- A. Shop drawings shall include, but not be limited to:
  - 1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

#### 3.5 REQUIREMENTS OF REGULATORY AGENCIES

- A. WORK IN ACCORDANCE WITH:
  - 1. National Electrical Code.
  - 2. Local, municipal, or state codes that have jurisdiction.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND COMPONENTS

#### A. General

Furnish and install power distribution, lighting and appliance panelboards and load centers as indicated in the panelboard schedule and as shown on the plans. Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

#### B. Busing Assembly and Temperature Rise

Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50°C. rise above 40°C ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.

1. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.

Provide a bare uninsulated and/or insulated ground bus and full size neutral bus as required and indicated in each panelboard enclosure.

#### C. 480/277 Volt Lighting Panelboards

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breaker shall have an over-center, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have “ON”, “OFF” and “TRIPPED” positions. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 277 volt ac (single pole, 15-30 amperes) or 480Y/277 volts ac (2 and 3 pole) with continuous current ratings as noted on the plan. Interrupting ratings shall be a minimum of 18,000 rms symmetrical amperes at 277 volts ac (single pole) or 480Y/277 volts ac (2 and 3 pole). Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

1. The lugs for terminating conductors shall be rated at 75° C on all panel boards and circuit breakers.

D. 240 Volt Lighting and Appliance Panelboard

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.

Circuit breakers shall be UL listed in accordance with UL standard 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.

Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.

UL Class A ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. Circuit breakers shall be rated 10,000 AIC at 240V unless otherwise noted on plans.

Provide double sized neutral bus with panels served from a non-linear transformer or when indicated on drawings. This shall be a UL approved assembly.

E. Cabinets and Fronts

The panelboard bus assembly shall be enclosed in a steel cabinet with multiple knockouts. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

F. Integrated Equipment Short Circuit Rating

Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure shall be

made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install panelboards, including electrical connections, in accordance with manufacturers written instructions, NEC and recognized industry practices.
- B. Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.
- C. Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

#### 3.2 IDENTIFICATION

- A. Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws.
- B. Directory Card: Place a neat, carefully typewritten directory card identifying the load served by each branch circuit in the frame on the panel door, under a clear plastic cover. Spares and spaces shall be written with erasable pencil for future use.
- C. Replacement Components: Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturers, the equipment enclosure(s) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state "caution - Series Rated System." (NEC 110-22). Nameplate shall also identify replacement components.

END OF SECTION 262416



## SECTION 262726 – WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide wiring devices as shown; scheduled, required and as specified.
- B. The types of wiring devices required include:
  - 1. Receptacles
  - 2. Switches
  - 3. Coverplates

#### 1.2 STANDARDS

- A. NEMA WD-1
- B. NEMA WD-5
- C. UL
- D. Federal Spec WC-596-F and WS-896

#### 1.3 ACCEPTABLE MANUFACTURERS

- A. Leviton Manufacturing
- B. Hubbell
- C. Pass & Seymour

#### 1.4 SUBMITTALS

- A. Shop drawings shall include but not limited to:
  - 1. Cut sheets of all devices indicating NEMA configuration, rating, materials, color, and all accessories.
  - 2. Cut sheets of all coverplates indicating materials, color and any engraving specified on drawing or in the specifications.

#### 1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

- A. National Electrical Code.
- B. Local, municipal, or state codes that have jurisdiction.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND COMPONENTS

- A. GENERAL
  - 1. Provide factory assemble wiring devices with the rating type and color as required and specified for the service indicated.
  - 2. Provide matching one-piece multiple gang plates where switches are ganged. Provide wall plates for each receptacle furnished.
  - 3. Architect reserves the right to select wiring device styles and colors to match wall finish.
  - 4. Wall plates shall be of same manufacturer as devices.

### 2.2 SWITCHES

- A. Provide specification grade gray toggle switches where indicated on the Drawings. Coordinate exact locations with architect.
- B. Wall switches shall be 20 amp, 120-277 volt and shall be Leviton, Hubbell or P&S as follows:
  - 1. SINGLE POLE SWITCHES:  
Leviton 1221-2, Hubbell HBL 1221, P&S PS20AC1

### 2.3 RECEPTACLES

- A. Provide specification grade gray receptacles where indicated on the Drawings. Coordinate exact location with architect.
- B. Receptacles shall be Leviton, Hubbell or Pass & Seymour as follows:
  - 1. Ground fault circuit interrupter (GFCI) receptacle 20A-125V; (Nema Configuration 5-20R, shall incorporate features which will lock-out or render the device incapable of being reset if ground fault protection is compromised, with "Feed through" connectors capable of protecting connected downstream receptacles on a single circuit, and of being installed in a 2-3/4" deep outlet box without adapter, Leviton 8899, P & S 2095.

### 2.4 PLATES

- A. Furnish and install plates on all outlet boxes. Oversize (Jumbo) plates are not acceptable.
- B. Provide Taymac Bell, Carlon or Leviton NEMA 3R weatherproof coverplates on all exterior wiring devices. Enclosure shall be suitable for wet locations when in use.

PART 3 - EXECUTION

3.1 WIRING DEVICE MOUNTING HEIGHTS

- A. Unless noted to the contrary on plans, or directed otherwise during the progress of the Work, wiring devices shall be set as follows:
  - 1. Receptacles at + 12" AFG.

3.2 INSTALLATION (Refer to 26 05 33/3.04 for outlet box specifications.)

- A. The Architect reserves the right to relocate wiring device up to a distance of 5 feet from the location shown, before rough-in, without additional cost.
- B. Stranded wire termination to switches, receptacles, devices and miscellaneous control devices shall be with an approved solderless terminal if clamp type securing is not possible (i.e. Sta-Con crimp on fork tongue connectors; Burndy Type TP-F).

END OF SECTION 262726

## SECTION 262810 - CLASS J FUSES

### PART 1 – GENERAL

#### 1.1 SCOPE

- A. Provide fuses as shown and scheduled and indicate by this specification section and other specifications sections.
- B. The type of fuses include:
  - 1. 600 volt current limiting.
  - 2. 250 volt current limiting.

#### 1.2 STANDARDS

- A. ANSI
- B. UL

#### 1.3 ACCEPTABLE MANUFACTURERS

Provide fuses manufactured by Bussman manufacturing.

#### 1.4 SUBMITTALS

- A. Shop drawings shall include, but not be limited to:
  - 1. Cutsheets of all fuses showing ratings and fuse curves.

#### 1.5 REQUIREMENTS OF REGULATORY AGENCIES

- A. WORK IN ACCORDANCE WITH:
  - 1. National Electrical Code.
  - 2. Local, municipal, or state codes that have jurisdiction.

### PART 2 - PRODUCTS

#### 2.1 CURRENT - LIMITING FUSES

- A. General: Provide 200,000 amp interrupting capacity current limiting fuses of the ampacity and voltage indicated and scheduled.
- B. Mains, Feeders and Branch Circuits
  - 1. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMAN HI-

CAP Time Delay Fuses KRP-C. Fuses shall employ "O" ring as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be peened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .1 seconds or less and be listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L.

2. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMAN LOW-PEAK Dual Element Fuses LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class J.
3. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMAN LOW-PEAK LPJ. The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMAN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMAN LOW-PEAK Dual-Element Fuses LPJ installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class LPJ or L. Circuit breaker panels shall be protected by BUSSMAN LOW-PEAK Dual-Element LPJ as shown on the drawings. The fuses shall be UL Class J.

## 2.2 SPARES

Upon completion of the building the contractor shall provide the owner with spare fuses as shown below.

- A. 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.
- B. BUSSMAN spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fuses: Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site or from installation. All fuses shall be furnished and installed by the electrical contractor. All fuses shall be of the same manufacturer.
- B. All fuses shall be installed in fuse holders.

END OF SECTION 262810

## SECTION 262816 - SAFETY AND DISCONNECT SWITCHES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide safety and disconnect switches as shown, scheduled and as specified herein.

#### 1.2 STANDARDS

- A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.
  - 1. NEMA KS1 - Enclosed switches
  - 2. Federal specification W-S-865C-Heavy duty switches
- B. Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

#### 1.3 ACCEPTABLE MANUFACTURERS

- A. Provide one of the following manufacturers:
  - 1. General Electric Company
  - 2. Square D Company
  - 3. Siemens
  - 4. Eaton

#### 1.4 SUBMITTALS

- A. Shop drawings shall include, but not be limited to:
  - 1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

#### 1.5 REQUIREMENTS OF REGULATORY AGENCIES

- A. WORK IN ACCORDANCE WITH:
  - 1. National Electrical Code.
  - 2. Local, municipal, or state codes that have jurisdiction.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

#### 2.2 MATERIALS AND COMPONENTS

A. Switch Interior

All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60°C and 75°C copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B. Switch Mechanism

Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C. Neutral

Provide a solid neutral with the safety switch where a neutral is present in the circuit.

D. Ratings

Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips or adjusted for Class J fuses. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E. Enclosures

1. Indoor switches shall be furnished in NEMA 1 enclosures.
2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.
3. Switches installed in wet areas such as cooling tower areas shall be NEMA 4X stainless steel or fiberglass reinforced polyester.
4. Switches installed in kitchens shall be stainless steel.
5. Switches installed in areas of a corrosive nature and subjected to salt air shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

F. Electrical Interlock Contacts

Provide electrical interlock contacts on all disconnect switches serving motors in which remote VFDs are serving the motor. Provide conductors from contacts to the safe circuit inside the VFD. De-energizing the disconnect switch shall signal VFD to stop.

G. Service Entrance

Switch shall be suitable for use as service entrance equipment when installed in accordance with the National Electrical Code.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer's written instructions, NEC and recognized industry practices.
- B. Location: Install switches within sight of controllers.
- C. Hubs: Provide bolt-on hubs for rainproof or wet area applications.

#### 3.2 IDENTIFICATION

- A. Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION 262816



## SECTION 262926 - MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

#### 1.2 SCOPE

- A. Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.
- B. The types of miscellaneous control devices and wiring include but not limited to the following.
  - 1. Contactors
  - 2. Relays
  - 3. Time switches
  - 4. Additional control wiring and safety devices as shown and specified.

#### 1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. WORK IN ACCORDANCE WITH:
  - 1. National Electrical Code.
  - 2. Local municipal or state codes that have jurisdiction.

#### 1.4 ACCEPTABLE MANUFACTURERS

- A. Provide one of the following manufacturers:
  - 1. LIGHTING CONTACTORS AND RELAYS
    - a. General Electric
    - b. Square D Company
    - c. Automatic Switch Company
  - 2. TIME SWITCHES
    - a. Intermatic time controls

## PART 2 - PRODUCTS

### 2.1 MATERIAL

- A. GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.
- B. CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system:
1. Rated at 600 volts, 60 hertz.
  2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
  3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
  4. The contactor shall have straight-through wiring with all terminals clearly marked.
  5. The contactor shall be approved per UL508 and/or CSA, and be designed in accordance with NEMA ICS2-21 1B.
  6. They shall be industrial-duty rated for applications to 600 volts maximum.
  7. The contactor shall have provisions for factory or field addition of:
    - a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
    - b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
  8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
  9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer.
  10. Electrically Held Lighting - Contactor coils shall be continuously rated and encapsulated. Electrically held contactors are not to be used unless specifically shown on the plans.
  11. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.
  12. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.
  13. Provide hand-off-automatic controls (H-O-A) for each lighting contractor.
- C. TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.
- D. Control wiring shall be not less than #14 AWG type TW, and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

PART 3 - EXECUTION

- 3.1 Install miscellaneous electrical controls and wiring to provide a functioning system.
- 3.2 Provide miscellaneous connections for signs and other furnished equipment as shown on the Drawings.

END OF SECTION 262926

## SECTION 265100 - LIGHTING FIXTURES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Furnish and install general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.
- B. The types of lighting fixtures required for this project include:
  - 1. Fluorescent
  - 2. LED

#### 1.2 STANDARDS

- A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings.
- B. All fluorescent ballast shall comply with certified ballast manufacture (CBM) standard and CBM labeled.
- C. NFPA 101
- D. ANSI C82.1
- E. NEMA-LE
- F. IEEE Publication 587 Category "A" (Electronic Ballast)
- G. All LED drivers shall be UL recognized Class 2 per UL1310 or non-Class 2 per UL 1012 as applicable.
- H. All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, for Non-Consumer Equipment.
- I. All LED drivers shall be RoHS compliant.
- J. TM-21
- K. LM-80
- L. LM-79
- M. L70
- N. DLC

### 1.3 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as shown and scheduled.

B. BALLAST:

1. Provide one of the following manufacturers
  - a. Advance Transformer Company
  - b. Universal Lighting Technologies
  - c. Osram Sylvania

C. LAMPS:

1. Provide one of the following manufacturers
  - a. Osram Sylvania
  - b. North American Philips

### 1.4 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B. Provide ballast and lamp data brochures indicating which lamp and ballast (if required) will be used in each fixture type.

### 1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND COMPONENTS

A. General:

Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, lamps, lamp holders, ballast, starters, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B. Lighting Fixture Types:

1. Fluorescent Fixtures

- a. Fixture ballast and lamp holders shall be pre-wired and installed. Fixture shall be equipped with a top access plate with knockouts for conduit entry. Fixture shall also include knockouts at each end plate for conduit entry.
- b. Provide disconnect switch as required by the 2014 National Electrical Code.
- c. Fixtures shall be cold roll steel finished using a multistage iron phosphate pretreatment to ensure maximum bonding and rust inhibitor. Finish shall be a lighting grade, baked white enamel finish with a minimum reflectance of 85%.
- d. Door frame shall be heavy gauge flush white steel or aluminum and hinged from one side and use a positive spring action latch on the other side for latching.
- e. Any lamp shall be easily replaced without removing another lamp.
- f. Fixtures installed in continuous rows shall utilize nipples or other accessories such as snap together plug in connectors supplied by the fixture manufacturer.
- g. Provide battery ballast for emergency light fixtures.

2. LED Fixtures

- a. Fixtures shall be pre-wired with frame-in kit and integral thermal protection required by UL for recessed fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.
- b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.
- c. LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50 $\mu$ s, 2 ohm combination wave).

2.2 BALLASTS AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. Fluorescent

1. Program start electronic ballast shall be high power factor 98% minimum), operate lamp at 40 KHz, less than 10% total harmonic content, normal ballast factor 50,000 switching cycles, universal voltage, crest factor less than 1.7, multi-lamp, class “P” thermally protected, sound “A” rating, encased and potted and 0°F minimum starting temperature. Provide 5 year warranty parts and labor. Ballast shall be Osram Sylvania PSN Series or approved equal by Universal Lighting Technologies or Advance Transformer Company.
2. All outdoor ballast unless otherwise noted shall be high power factor, rapid start, class P thermally protected, encased and potted, sound rating B and a 0°F temperature rating. Ballast shall be CBM certified by an ETL and UL approved.
3. Provide suitable dimming ballast where indicated.
4. Compact fluorescent ballast shall be electronic, shall have circuitry designed to shut down the system reliably and safely when lamps have reached their end of life, high power factor, sound rating “A” and UL approved. Provide 5-year warranty, parts and labor.

B. LED

1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.
2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.
3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).
4. Provide driver with integral color-coded leads.
5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.
6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.
7. Provide drivers with a Class A sound rating.
8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).
9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.
11. Driver performance requirements shall be met when operated to 50% of full load rating.
12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
13. Drivers shall comply with NEMA 410 for in-rush current limits.
14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

2.3 LAMPS – COORDINATE WITH LIGHT FIXTURE SCHEDULE

- A. Extended life F032 T8 Fluorescent lamps shall be 40,000 hours 3,500°K, 32 watt and low mercury. Life rating is based on 3 hours/start using programmed start ballast.
- B. All compact fluorescent (T5 and smaller diameter) lamps shall be 3500°K and 4-pin

PART 3 - EXECUTION

3.1 INSTALLATIONS

- A. General

1. Install the type of light fixture where shown and indicated in accordance with manufacturer's written instructions.
2. Provide earthquake clips on all recessed lay-in light fixtures as required by building code.
3. Adjust all adjustable light fixtures, as directed by the Architect.
4. Provide safety chains and wire guards for light fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination

1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.
2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.
3. Refer to architectural reflected ceiling plan for the exact location of all light fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting

1. Provide support channels to support outlet boxes used support surface mounted light fixtures such as exit signs or downlights.
2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickey and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.
3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.

D. Electrical Connection



1. All light fixtures installed in an accessible suspended ceiling shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 8'- 0". All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in an accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

G. Warranty

1. Provide 5 year parts and labor on all LED light fixtures including fixture housing, wiring, LED chipsets, and all other associated components.

3.2 FINAL INSPECTION

- A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.
- B. All lamps used during construction shall be replaced with new lamps. Replace all other defective ballast, lamps or discolored lamps, showing signs of excessive usage.
- C. Demonstrate proper operation of all fixtures and controls.

END OF SECTION 265100

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April 2013

## **Grasspave2 Product Specification (CSI Format)**

Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) Format, including *MasterFormat* (1995 Edition), *SectionFormat*, and *PageFormat*, contained in the *CSI Manual of Practice*.  
The section must be carefully reviewed and edited by the Engineer to meet the requirements of the project and local building code. Coordinate with other specification sections and the drawings.  
Delete all "Specifier Notes" when editing this section.

### **SECTION 32 12 43 POROUS FLEXIBLE PAVING (Formerly 02795 Porous Paving)**

#### **PART 1 GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Porous pavement system.

##### **1.2 RELATED SECTIONS**

- A. Section 31 20 00 – Earth Moving
- B. Section 32 93 00 Plants
- C. Section 32 84 00 – Irrigation or Section 32 84 13 – Drip Irrigation

### 1.3 REFERENCES

- A. ASTM F 1951-08 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
- B. ASTM D 638-10 Standard Test Method for Tensile Properties of Plastics
- C. ASTM C 33 Standard Specification for Concrete Aggregates
- D. AASHTO M6 Standard Specification for Fine Aggregate for Hydraulic Cement Concrete

### 1.4 SYSTEM DESCRIPTION

- A. The Grasspave2 porous pavement system provides vehicular and pedestrian load support for grass areas, while protecting grass roots from harmful effects of traffic.
- B. Major Components of the Complete System
  - 1. Grasspave2 units, assembled in rolls.
  - 2. Engineered sand and gravel base course.
  - 3. Hydrogrow soil amendment and fertilizer, supplied with Grasspave2.
  - 4. Sand fill or USGA greens mix.
  - 5. Selected grass from seed, hydroseeding/hydro-mulching, or sod.
  - 6. Selected topsoil (only for seeded installation).
  - 7. Mulch (needed only for seeded or hydroseeded installations).
- C. The Grasspave2 grass paving units, sand, and base course work together to support imposed loading.
- D. The Grasspave2 grass paving units, Hydrogrow, and sand fill contribute to vegetation support.

### 1.5 SUBMITTALS

- A. Submittals shall conform to requirements of General Conditions 5.12 – Contract Drawings.
- B. Shop Drawings: Submit design detail showing proper cross-section.
- C. Samples: Submit manufacturer's sample of Grasspave2 10" x 10" section of Grasspave2 material.
- D. Installation Instructions: Manufacturer's printed installation instructions. Include methods for maintaining installed products.
- E. Certificates:
  - 1. Manufacturer signed certificate stating the product is made in the USA.
  - 2. Submit Material Certificates for base course and sand (or USGA mix) fill materials
  - 3. Product certificates signed by the manufacturer certifying material compliance of polyethylene used to make Grasspave2 units.
  - 4. ISO Certificate certifying manufacturer's quality management system is currently registered to ISO 9001:2008 quality standards.
- F. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
  - 1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
  - 2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
  - 3. Description of Grasspave2 in stormwater design to limit the disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants.
  - 4. Designing elements for Grasspave2 to limit the disruption and pollution of natural water flows by managing stormwater runoff.
  - 5. Documenting the use of Grasspave2 to reduce heat islands to minimize the impact on microclimates and human and wildlife habitats.

- G. Substitutions: No material will be considered as an equivalent to the Grasspave2 unit specified herein unless it meets all areas of this specification without exception. Manufacturers seeking to supply what they represent as equivalent material must submit records, data, independent test results, samples, certifications, and documentation deemed necessary by the Specifier to prove equivalency.
- H. Manufacturer's Material Certification: Product manufacturers shall provide certification of compliance with all applicable testing procedures and related specifications upon written request. Request for certification shall be submitted by the purchasing agency no later than the date of order placement.
- I. Product manufacturers shall also have a minimum of 30 years' experience producing products for porous pavement systems.
- J. Manufacturer Quality Certification: ISO Certification certifying manufacturer's quality management system for its Grasspave2 system is currently registered to ISO 9001:2008 quality standards. Any alternate materials submitted shall provide a certification that their porous pavement system manufacturing process is part of an ISO program and a certification will be required specifically stating that their testing facility is certified and in accordance with ISO.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect Grasspave2 units/rolls from damage during delivery and store rolls upright, under tarp, to protect from sunlight, when time for delivery to installation exceeds one week.
- C. Store Hydrogrow in a dark and dry location
- D. Handling: Protect materials during handling and installation to prevent damage

## 1.7 MAINTENANCE SERVICE

- A. Installer responsible for maintenance of grass plants – water/irrigation, fertilizing, mowing – for one growing season. DO NOT AERATE. See *Grasspave2 Maintenance Guide* from Invisible Structures
- B. System to be maintained by East Aldine Management District, after one growing season.

## 1.8 Project Conditions

- A. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not begin installation of porous pavements until all hard surface paving adjacent to porous pavement areas, including concrete walks and asphalt paving, is completed.
- C. Install turf when ambient air temperatures is at least 55 degrees F (13 degrees C).
- D. In cold weather, do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen base or wet, saturated or muddy subgrade.
- E. Protect partially completed paving against damage from other construction traffic when work is in progress.
- F. Adequately water sod or grass seed to assure germination of seed and growth of root system.
- G. Grass coverage on the sand-filled Grasspave2 rings must be completed within one week: See *Part 3 Execution*.
- H. DO NOT DRIVE, PARK ON, or use Grasspave2 system for two or three mowing cycles until grass root system has matured (about 3 to 4 weeks for sod or 6 to 8 weeks for seeded areas). Any barricades constructed must still be accessible by emergency and fire equipment during and after installation.

## 1.9 LIMITED WARRANTY

- A. Invisible Structures, Inc. (ISI) warrants to its purchasers that all products furnished by ISI will be free from defects in material and/or workmanship.
- B. This warranty shall be extended for a period of five (5) years following the date of shipment by ISI.
- C. Providing a written claim is presented to ISI within the warranty period and after inspection by ISI showing the materials have failed under this warranty, all defective materials shall be refurbished under this warranty, at no charge, excluding re-installation costs. This in lieu of all other warranties expressed or implied and is the sole warranty extended by ISI.
- D. Our liability under this warranty is limited to the refurbishing of materials and does not include any responsibility for incidental, consequential, or other damages of any nature.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Invisible Structures, Inc., which is located at: 1600 Jackson St. Suite 310 ; Golden, CO 80401; Toll Free Tel: 800-233-1510; Tel: 303-233-8383; Email: [request info \(sales@invisiblestructures.com\)](mailto:request_info@invisiblestructures.com); Web: [www.invisiblestructures.com](http://www.invisiblestructures.com).
- B. Substitutions: Not permitted.

### 2.2 GRASSPAVE2

- A. Composition:
  - 1. Manufactured in the USA.
  - 2. High density polyethylene (HDPE): 100 percent recycled materials.
  - 3. Color: black
  - 4. Color Uniformity: Uniform color throughout all units rolls.
  - 5. Carbon Black for ultraviolet light stabilization.
  - 6. Hydrogrow soil amendment and fertilizer, provided by manufacturer with Grasspave2.
- B. Performance Properties:
  - 1. Maximum Loading Capability: 5721 psi (39,273 kPA) when filled with sand.
  - 2. Wheelchair Access testing for ADA Compliance: Passing ASTM F 1951-08.
  - 3. Wheelchair Access testing for ADA Compliance: Passing Rotational Penetrometer testing.
  - 4. Tensile strength, pull-apart testing: 458 lbf/in from ASTM D638 Modified.
  - 5. System Permeability (Grasspave2, sand, base course): 2.63 to 38.55 inches of water per hour.
  - 6. Effective Imperviousness (E.I.): 10%.
- C. Dimensions (individual units are assembled and distributed into rolls):
  - 1. Roll area: From 108 sq ft (10 sq m) to 538 sq ft (50 sq m), in 108 sq ft (10 sq m) increments
  - 2. Roll Widths: From 3.3 ft (1 m) to 8.2 ft (2.5 m), in 1.6 ft (0.5 m) increments.
  - 3. Roll Lengths: From 32.8 ft (10m) to 65.6 ft (20 m), in 3.3 ft (1 m) increments.
  - 4. Roll Weights: From 41 lbs (19kg) to 205 lbs (93kg), in 41 lbs (19 kg) increments.
  - 5. Unit Nominal Width by Length: 20 inches by 20 inches (0.5 m by 0.5 m) or 40 inches by 40 inches (1 m by 1 m).
  - 6. Nominal Depth: 1 inch (2.5 cm) – for rolls and individual units.
  - 7. Unit Weight: 18 oz (510 g) or 5 lbs. (2.27 kg).
  - 8. Volume Solid: 8 percent.

### 2.3 SYSTEM MATERIALS

- A. Base Course: Sandy gravel material from local sources commonly used for road base construction (recycled materials such as crushed concrete or crushed asphalt are NOT acceptable).
  1. Conforming to the following sieve analysis and requirements:
    - a. 100 percent passing sieve size 1 inch (25 mm).
    - b. 90-100 percent passing sieve size 3/4 inch (19 mm).
    - c. 70-80 percent passing sieve size 3/8 inch (9 mm).
    - d. 55-70 percent passing sieve size #4.
    - e. 45-55 percent passing sieve size #10.
    - f. 25-35 percent passing sieve size #40.
    - g. 3-8 percent passing sieve size #200.
  2. Provide a base course material nearly neutral in pH (range from 6.5 to 7.2) to provide adequate root zone development for turf.
  3. Material may be either "pit run" or "crusher run." Avoid using clay based crusher run/pit run. Crusher run material will generally require coarse, well-draining sand conforming to AASHTO M6 or ASTM C 33 to be added to mixture (20 to 30 percent by volume) to ensure long-term porosity.
  4. Alternative materials such as crushed shell, limerock, or crushed lava may be used for base course use, provided they are mixed with sharp sand (20 to 30 percent) to ensure long-term porosity, and are brought to proper compaction. Without added sand, crushed shell and limerock set up like concrete and become impervious.
  5. Alternative size and/or composition of base course materials should be submitted to Invisible Structures, Inc. (Manufacturer) for approval.
- B. Sand Fill for Rings and Spaces Between Rings: Clean sharp sand (washed concrete sand). Choose one of the following:
  1. Coarse, well-draining sand, such as washed concrete sand conforming to AASHTO M6 or ASTM C-33.
  2. United States Golf Association (USGA) greens, section - sand mix "The Root Zone Mixture."
- C. Turf Conditioner:
  1. Hydrogrow a proprietary soil amendment manufactured by Invisible Structures, Inc. and provided with Grasspave2.
  2. NO SUBSTITUTIONS.
- D. Grass
  1. Sod: Use 13 mm (0.5") thick (soil thickness) rolled sod from a reputable local grower. Species should be wear resistant, free from disease, and in excellent condition. Sod shall be grown in sand or sandy loam soils only. Sod grown in soils of clay, silt, or high organic materials such as peat, will not be accepted.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. Examine subgrade and base course installed conditions. Do not start porous paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.
- B. For fire lane installations: prior to installing base course for turf paving, obtain approval of local fire authorities of sub-base.
- C. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact Architect for resolution.

### 3.2 PREPARATION

Notes: Ensure that subbase materials are structurally adequate to receive designed base course, wearing course, and designed loads. Generally, excavation into undisturbed normal strength soils will require no additional modification. Fill soils and otherwise structurally weak soils may require modifications, such as geotextiles, geogrids, and/or compaction (not to exceed 90%). Ensure that grading and soil porosity of the subbase will provide adequate subsurface drainage

#### A. Subgrade Preparation:

1. Prepare subgrade as specified in Section 0220. Verify subgrade in accordance with porous paving system manufacturer's instructions.
2. Proper subgrade preparation will enable the Grasspave2 rolls/units to connect properly and remain level and stationary after installation.
3. Excavate area allowing for unit thickness, the engineered base depth (where required), and 0.5 inch (1.25 cm) for depth of sod root zone or topsoil germination area (when applicable).
4. Provide adequate drainage from excavated area if area has potential to collect water, when working with in-place soils that have poor permeability.
5. Ensure in-place soil is relatively dry and free from standing water.
6. Uniformly grade base.
7. Level and clear base of large objects, such as rocks and pieces of wood.

#### B. Base Preparation:

1. Install Base as specified in Section 32 10 00. Verify engineered base (if required) is installed in accordance with porous paving system manufacturer's instructions.
2. Coordinate base installation and preparation with subdrains specified in Section 33 46 00.
3. If required, place a geotextile separation layer between the natural ground and the 'engineered base'.
4. If required, install the specified sub-drain and outlet according to construction drawings.
5. Coordinate base installation and preparation with irrigation and drip irrigation lines specified in Section 32 80 00 and 32 84 13, respectively.
6. Place engineered base in lifts not to exceed 6 inches (150 mm), compacting each lift separately to 95 percent Modified Proctor.
7. Leave 1 inch (2.5 cm) of depth below final grade for porous paver unit and sand fill and 0.5 inch (1.25 cm) for depth of sod root zone or topsoil germination area (when applicable).

### 3.3 HYDROGROW INSTALLATION

- A. Spread all Hydrogrow mix provided (spreader rate = 4.53 kg per 100 m<sup>2</sup> (10 lbs per 1076 ft<sup>2</sup>) evenly over the surface of the base course with a hand-held, or wheeled, rotary spreader.
- B. The Hydrogrow mix should be placed immediately before installing the Grasspave2.

### 3.4 GRASSPAVE2 INSTALLATION

- A. Install the Grasspave2 units by placing units with rings facing up, and using snap-fit connectors, pegs and holes, provided to maintain proper spacing and interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves, slopes, and high traffic areas shall be anchored to the base course, using 40d common nails with fender washer, as required to secure units in place. Tops of rings shall be between 6 mm to 13 mm (0.25" to 0.5") below the surface of adjacent hard-surface pavements.
- B. Install sand in rings as they are laid in sections by "back-dumping" directly from a dump truck, or from buckets mounted on tractors, which then exit the site by driving over rings already filled with sand. The sand is then spread laterally from the pile using flat bottomed shovels and/or wide "asphalt rakes" to fill the rings. A stiff bristled broom should be used for final "finishing" of the sand. The sand must be "compacted" by using water from hose, irrigation heads, or rainfall, with the finish grade no less than the top of rings and no more than 6 mm (0.25") above top of rings.

### **3.5 INSTALLATION OF GRASS**

- A. Grass coverage on the sand-filled rings must be completed within one week. Sand must be re-installed and leveled and Grasspave2 checked for integrity if rings become exposed due to wind, rain, traffic, or other factors.
  - 1. Install thin sod directly over sand filled rings, filled no higher than the top of the rings. Sod strips should be placed with very tight joints. Sodded areas must be fertilized and kept moist during root establishment (minimum of 3 weeks). **DO NOT DRIVE ON SYSTEM:** Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until the root system has penetrated and established well below the Grasspave2 units.
- B. Adequately water sod or grass seed to assure germination of seed and growth of root system.

### **3.6 PROTECTION**

- A. Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until the root system has penetrated below the Grasspave2 units.

### **3.7 FIELD QUALITY CONTROL**

- A. Remove and replace segments of Grasspave2 units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.
- B. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

### **3.8 MAINTENANCE**

- A. Maintain grass in accordance with manufacturer's instructions and as specified in Section 32 92 00 Manufacturers of Turfs and Grasses.
- B. Lawn Care: Normal turf care procedures should be followed, including de-thatching.
- C. **DO NOT AERATE.** Aerator will damage the Grasspave2 units. Aeration is not necessary in a sand root zone.
- D. When snow removal is required, keep a metal edged plow blade a minimum of  $\frac{3}{4}$  inch (17 mm) above the surface during plowing operations to avoid causing damage to the Grasspave2 units, or
  - 1. Use a plow blade with a flexible rubber edge, or
  - 2. Use a plow blade with skids on the lower outside corners set so the plow blade does not come in contact with the units.

**END OF SECTION**



## SECTION 321313 - CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Walks.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Other Action Submittals:
  - 1. 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.

#### 1.3 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

### PART 2 - PRODUCTS

#### 2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- E. Deformed-Steel Wire: ASTM A 496/A 496M.

- F. Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.
- G. 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.

## 2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150, gray portland cement Type II.
    - a. Fly Ash: ASTM C 618, Class C.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- 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.

## 2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- 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.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

## 2.4 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

## 2.5 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), with the following properties:
  - 1. Compressive Strength (28 Days): 3000 psi.
  - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
  - 3. Slump Limit: 5 inches, plus or minus 1 inch.
  - 4. Air Content: 5-1/2 percent plus or minus 1.5 percent.
- B. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

## 2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.2 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.

### 3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

### 3.4 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.
- 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.
- 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.
- 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.
- 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.

### 3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, placing, and consolidating concrete.
- C. 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.
- D. Screed paving surface with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

### 3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water 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. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
  2. 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.
  3. 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.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions.
1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
  2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

### 3.7 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.

### 3.8 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-foot-long, unlevelled straightedge not to exceed 1/2 inch.
  4. Joint Spacing: 3 inches.
  5. Contraction Joint Depth: Plus 1/4 inch, no minus.
  6. Joint Width: Plus 1/8 inch, no minus.

3.9 REPAIRS 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. 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.
- C. 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 321313

## SECTION 321400 - UNIT PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Concrete pavers set in aggregate and mortar setting beds.

#### 1.2 SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Samples for unit pavers.

#### 1.3 QUALITY ASSURANCE

- A. The Contractor is responsible for correction of work which does not conform to the specified requirements, including strength, tolerances and colors. Correct deficient materials as directed by the Owner.
- B. Installer: a firm with a minimum of (3) three years experience in the successful installation of similar pavers in similar quantities. Firm must provide Owner a list of jobs completed which can be inspected by Owner or Owner's Representative. A minimum of 2 of these completed jobs must be located in the area similar to this job.

#### 1.4 WARRANTY

- A. Warrant the work specified herein for 1 year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non conforming materials and workmanship.

#### 1.5 PRODUCT HANDLING

- A. Concrete pavers shall be delivered and unloaded at jobsite on pallets and bound in shrink wrap plastics covers to prevent rust staining from steel strapping and in such a manner that no damage occurs to product during hauling, handling or unloading at the jobsite.

#### 1.6 MOCK-UPS

- A. Provide layout and pattern mock-ups on jobsite at approved location.

- B. Mock-ups shall remain on the jobsite for the duration of the project unless otherwise directed by Owners Representative.

#### 1.7 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or build on frozen subgrade or setting beds.
- B. Weather Limitations for Bituminous Setting Bed: Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.
- 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. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

### PART 2 - PRODUCTS

#### 2.1 UNIT PAVERS

- A. Concrete Pavers: Solid interlocking paving units complying with ASTM C 936 made from normal-weight aggregates.

#### 2.2 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

#### 2.3 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 8.
- B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
- C. Sand for Joints: HP Polymeric jointing sand or approved equal.
- D. Soil Separator or Filter Fabric shall be Polyspun XL Soil Separator; heavy duty, non-woven, with permeability minimum 275 gallons of water per min. per square foot.



## 2.4 MORTAR SETTING-BED MATERIALS

- A. Regional Materials: Provide aggregate, cement, and lime for mortar that has been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Portland Cement: ASTM C 150, Type I or Type II.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Sand: ASTM C 144.
- E. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
- F. Water: Potable.

## 2.5 MORTAR AND GROUT MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions. Discard mortars and grout if they have reached their initial set before being used.
- B. Mortar-Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.
- C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.
- D. Latex-Modified, Portland Cement Setting-Bed Mortar: Comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
- E. Latex-Modified, Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.
- F. Packaged Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- B. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.
  - 1. For concrete pavers, a block splitter may be used.

- C. Joint Pattern: As indicated.
- D. Tolerances: Do not exceed 1/16-inch and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- E. Expansion and Control Joints: Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.
- F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

### 3.2 SAND SETTING

- A. Sand:
  - 1. Spread a maximum of 1" sharp sand over the area to receive concrete pavers.
  - 2. Screed until level to the grade and profile required. Minimum depth of sand should be 1" and maximum depth shall be 1 1/2".
  - 3. Pavers shall be clean and free of foreign materials before installation.
  - 4. Installation should start from a corner or straight edge and proceed forward over the undisturbed sand laying course. Installation shall be carried out where possible to minimize cutting pavers.
  - 5. Paving work shall be plumb, level and true to line and grade; shall be installed 1/8" higher than adjacent paved surfaces after compaction to allow for settlement. All edges must be retained as per Detail.
  - 6. Paving units shall be installed hand tight and level on the undisturbed sand laying course. String lines should be used to hold pattern lines true. Joint spaces shall not exceed 1/8".
  - 7. Cutting of paving units to be done only with an approved masonry saw. Contractor shall take note of areas designated as 'no cut' paver areas. Contractor to adjust walk width to accommodate full size pavers only where noted on drawings.
  - 8. All 'end pavers' to be full size pavers when feasible. Any cut pavers shall not be less than 1/3 of full size.
  - 9. After initial placement of pavers, sweep and vibrate dry joint sand into the joints using a plate vibrator until all joints are completely filled with joint sand. The number of passes with the vibrator and effort required to produce completely filled joints will vary on gradation, moisture content, weather, adjustment of the vibrating plate, etc. Vibration and filling of joints is to be completed to within 6' of any unconfined edge at the end of each day.
  - 10. Visually and physically inspect all joints to insure that they are completely filled and compacted. Refill and re-compact joints until a rigid putty knife cannot be inserted more than 1/4" into the joint.
  - 11. Excess sand shall be swept into the joints or disposed of from the surface area when joints are completely filled.

### 3.3 MORTAR SETTING-BED APPLICATIONS

- A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

- B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat.
- C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
- E. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- F. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each paver with a flat trowel.
- G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- H. Grouted Joints: Grout paver joints complying with ANSI A108.10.
- I. Grout joints as soon as possible after initial set of setting bed.
  - 1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
  - 2. Tool exposed joints slightly concave when thumbprint hard.
- J. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.
- K. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
  - 1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.

#### 3.4 ATTIC STOCK

- A. Contractor shall provide 50 additional pavers of each type used to the Owner for attic stock.

END OF SECTION 321400

## SECTION 328400 - PLANTING IRRIGATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes piping, valves, sprinklers, accessories, controls, and wiring for an automatically control irrigation system.

#### 1.2 DEFINITIONS

- A. Irrigation Lateral Lines: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Irrigation Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

#### 1.3 SUBMITTALS

- A. Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:
  - 1. Control valves.
  - 2. Sprinkler heads and emission devices.
  - 3. Irrigation controller.
  - 4. Pipe and fittings.
  - 5. Wire and connectors.
  - 6. Solvents.
  - 7. Valve boxes.
- B. Evidence of State of Texas irrigation license and required experience.
- C. Operation and maintenance instructions.
- D. Spares and Special Tools – Provide Owner with 2 spare sprinkler heads of each size and type.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Installer – Installation of Irrigation System installation shall be performed under the direction of a State of Texas licensed irrigator with not less than 5 years experience in this type of work.

1.5 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- C. Mainline PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 40.
  - 1. PVC Socket Fittings, Schedule 40: ASTM D 2466.
- D. Irrigation Lateral Line Pipe
  - 1. Pipes  $\frac{3}{4}$  inch diameter and larger: ASTM D 2231, PVC, 1120 or 1220, SDR 21.0, 200 PSI
  - 2. Pipes  $\frac{1}{2}$  inch diameter: ASTM D 2241, PVC, 1120 or 1220, SDR 13.5, 315 PSI
- E. FITTINGS FOR SOLVENT WELDED JOINTS
  - 1. Schedule 40: ASTM D 2466
- F. FITTINGS FOR THREADED JOINTS
  - 1. ASTM D 2466, PVC, Schedule 40

## 2.2 GENERAL-DUTY VALVES

- A. Bronze Gate Valves shall be MSS SP-80, Class 125, Type 1, nonrising-stem, bronze body with solid wedge, threaded ends, and malleable-iron handwheel.

## 2.3 REMOTE CONTROL VALVES

- A. Plastic Automatic Control Valves shall be molded-plastic body, normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.
- B. Quick-Couplers shall be factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, purple rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
- C. Remote Control-Valve Boxes: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. Include size as required for valves and service.
  - 1. Valve boxes shall be heavy duty plastic 17 inch by 11-3/4 inch by 12 inch depth, black with black cover. Valve box shall be Series 1419, non-hinged, non-bolt cover, by Carson Industries, Inc., 1925 Street, LaVerne, CA 91750, 213-732-6265, or approved equal.
  - 2. Valve boxes shall be heavy duty plastic 17 inch by 11-3/4 inch by 12 inch depth, purple with purple cover. Valve box shall be Series 1419, non-hinged, non-bolt cover, by Carson Industries, Inc., 1925 Street, LaVerne, CA 91750, 213-732-6265, or approved equal.
  - 3. Valve boxes shall be precast concrete with compressive strength of concrete in excess of 4000 psi. Valve box shall be approximately 14 5/8" by 19 3/4" with bolt down cast iron traffic cover. Valve box shall be 36-T, by Brooks Products, or approved equal.
- D. Gate Valve and Control Wire Splice Boxes
  - 1. Control wire splice boxes shall be heavy duty plastic 10 inch diameter by 10-1/4 inch deep, black with black cover, No. 910-12B, by Carson Industries, Inc. or approved equal.
  - 2. Valve boxes for quick couplers, wire splices and gate valves shall be precast concrete with compressive strength of concrete in excess of 4000 psi. Valve box shall be 12 1/2 inch diameter by 10-1/2 inch deep, with cast iron cover. Valve box shall be No. 101, by Brooks Products, Inc. or approved equal.
- E. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/8 inch minimum to 1 inch maximum.

## 2.4 SPRINKLERS

- A. Description: Brass or plastic housing and corrosion-resistant interior parts designed for uniform coverage over entire spray area indicated, at available water pressure shall include.
  - 1. Flush, Surface Sprinklers: Fixed pattern, with screw-type flow adjustment.
  - 2. Bubblers: Fixed pattern, with screw-type flow adjustment.
  - 3. Shrubbery Sprinklers: Fixed pattern, with screw-type flow adjustment.

4. Pop-up, Spray Sprinklers: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.
5. Pop-up, Rotary, Spray Sprinklers: Gear drive, full-circle and adjustable part-circle types.
6. Pop-up, Rotary, Impact Sprinklers: Impact drive, full-circle and part-circle types.
7. Aboveground, Rotary, Impact Sprinklers: Impact drive, full-circle and part-circle types.

## 2.5 SPRINKLER SPECIALTIES

- A. Strainer/Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
- B. Emitters: PE or vinyl body.
  1. Single-Outlet Emitters: To deliver the following flow at approximately 20 psig:
    - a. Flow: 1 gph.
    - b. Tubing Size: ¼" ID.
  2. Outlet Caps: Plastic, for outlets without tubing.
- C. Drip Tubes: 17mm, flexible PE or PVC tubing for emitters and other devices, of length indicated and with plugged end.

## 2.6 CONTROLLER

- A. Controller shall be "Two-wire" type as specified on drawings.
  1. Controller shall be capable of fully automatic or manual operation of the system.
  2. Controller shall operate on a minimum of 117 volts A.C. input power and be capable of operating 24 volt A.C. electric remote control valves. Controller shall have a reset circuit breaker to protect it from power overload.
  3. The controller shall have the specified number of stations. Each station shall have a time setting control capable of being set for incrementally variable timing or set to omit the station from the irrigation cycle.
  4. Controller shall have a 365 day calendar, event day off, water budget, cycle and soak and a master "on-off" switch.
  5. Controller shall have a UL-listed 24V AC transformer. Operation instructions and location of water source supplying system shall be printed on face of controller. Section location chart shall be placed inside cabinet door.

## 2.7 WIRING

1. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers and runs over 1,000 LF.
2. Low-Voltage, Branch-Circuit Cables: No. 14-2 Maxi-wire as provided by Rainbird Corporation between controller and automatic valve decoders installation in same trench with pvc pipe..

3. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

2.8 BACKFLOW PREVENTERS

- A. Backflow Preventers shall be bronze and copper, reduced pressure type assembly Wilkins **No. 375** by Wilkins, Inc. (Zurn Industries LLP), 1801 Pttsburg Avenue, Erie, PA , 16502, 855-663-9876, or approved equal. Size as per drawings.

2.9 REMOTE CONTROL VALVE TIES

- A. Remote control valve ties shall be plastic tags with wire to attach numbered tag to valve.

2.10 SOLVENT CEMENT FOR SOLVENT WELDED JOINTS

- A. CHRISTY'S RED HOT BLUE GLUE T. Christy Enterprises, Inc., 1207 W. Struck Avenue, No. E, Orange, CA 92667, 800-258-4583, or approved equal. Use a compatible primer recommended by the solvent cement manufacturer.

2.11 SEALANT FOR THREADED JOINTS UNDER CONSTANT PRESSURE

- A. RECTOR SEAL LIQUID TEFLON by Rector Seal Corp., 2830 Produce Row, Houston, Texas 77023, 713-928-6423, or approved equal.

2.12 SLEEVES UNDER PAVING FOR CONTROL WIRE AND IRRIGATION LINES

- A. ASTM D 2455, PVC, Schedule 40 sized as shown on drawings.

2.13 FITTINGS FOR THREADED JOINTS

- A. ASTM D 2466, PVC, Schedule 80.

2.14 BACKFLOW ENCLOSURES

- A. The backflow enclosure shall be Strong Box model no. SBBC-CR as manufactured by V.I.T. Products, Inc., 800-729-1314.]

2.15 RAINFALL MONITOR

- A. Provide a Mini-Click by Glen Hilton Products or approved equal.



### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
- B. Location of Heads – Design location is represented as accurately as possible. Make minor adjustments on site with approval of Landscape Architect as necessary to ensure consistent and even spacing where applicable. Set all heads minimum 6” from back of curb and 4” from edge of concrete walls.
- C. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.
- D. Provide minimum cover over top of underground piping according to the following:
  - 1. Irrigation Main Piping: Minimum depth of 18 inches below finished grade.
  - 2. Circuit Piping: 12 inches.
  - 3. Sleeves: 24 inches
- E. BACKFILL - Backfill with clean material from excavation after obtaining Landscape Architect’s approval. Remove organic material, as well as rocks and debris larger than 1 inch in diameter. Place acceptable backfill in 6 inch lifts and water jet all trenches.
- F. EXISTING LAWNS – Where trenching is required across existing lawns, (or in even 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.
  - 1. 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.
  - 2. Replant sod within 2 days after removal, roll and water generously.
  - 3. Resod and restore to original condition all sod areas not in healthy condition equal to adjoining lawns 30 days after replanting.

#### 3.2 INSTALLATION

- A. General - Unless otherwise indicated, Contractor shall comply with requirements of the governing Uniform Plumbing Code.
- B. Pipes
  - 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.
  - 2. PVC Pipe Assembly
    - a. Cut PVC pipe square and de-burr. Clean pipe and fittings using primer as recommended by the PVC pipe manufacturer. Use purple tinted primer to aid in visual inspection.

- b. 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.
      3. 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.
      4. Plastic pipe shall be snaked in the trenches in a manner to provide for expansion and contraction as recommended by pipe manufacturer.
- C. Sleeves Under Paving - The majority of sleeves under paving are existing as shown on drawings. Where boring is required for new sleeves (refer to drawings), it shall be a "wet bore." Install sleeves 12" beyond edge of pavement. Perform trench and backfill in accordance with these specifications.
- D. Irrigation Heads
  1. Flush irrigation lines with full head of water and install heads after hydrostatic test is completed.
  2. Install heads at manufacturer's recommended heights.
  3. Locate part-circle heads to maintain a minimum distance of 4, 12, 24, 48 inches from walls and 2 inches from other boundaries, unless otherwise indicated.
  4. Check for uniformity of coverage and pattern correctness. Adjust for 100% coverage where required.
  5. Install nozzles with water running at reduced pressure starting with the head closest to the valve.
  6. Adjust arcs and radius at normal operating pressure.
- E. Drip Tubing
  1. Tubing installed in planting beds is to be placed at spacing indicated on drawings in shallow trench and covered with planting backfill mix 1"-2" deep and then covered with mulch. Tubing is to be placed after bed preparation is complete and plant material is planted. Refer to Section 329300 – Plants.
  2. Drip tubing is to be placed on top of root balls of trees in planting beds to allow for even watering of trees.
  3. All tubing is to be reviewed by Owner's Representative prior to burying.
- F. Electric Remote Control Valves
  1. Adjust automatic control valves to provide flow rate at rated operating pressure required for each irrigation section.
  2. 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 exist.
- G. 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.

- H. Valve Boxes - Install valve boxes to cover electric remote control valves. Install one valve per valve box. Top of valve box shall be flush with finished grade. Bury minimum 4 bricks under base of each box as support.
- I. Control Wire Splice Boxes - Install control wire splice box to cover any splice in control wire. Top of valve box shall be flush with finished grade. Bury minimum 4 bricks under base of each box as support. Install control wire splice box to cover wires pulled for future valves.
- J. Gravel Backfill - Backfill valve boxes and control wire splice boxes with gravel, minimum 6 inch depth.
- K. Electric Controller
  - 1. Controllers shall be fully grounded.
  - 2. Connect remote control valves to controller in clockwise sequence to correspond with stations 1, 2, 3, successively.
  - 3. Affix a non-fading copy of irrigation diagram to cabinet door below controller's name. Irrigation diagram shall be sealed between two plastic sheets, 20 mils. minimum thickness. Irrigation diagram shall show clearly all valves operated by the controller, showing station number, valve size, and type of planting irrigated.
  - 4. Provide galvanized padlock against vandalism. Provide two keys to Owner. Keys to be matched with existing controller key locking mechanisms.
  - 5. Power to Controller & Locations: Location shown on plan for controller is approximate. Final location shall be determined on site by Owner. Contractor shall supply 120 VAC to controller from adjacent existing power sources. Follow local governing codes in electrical work.
- L. Irrigation Control Wires
  - 1. Provide 24 volt “Two-wire” system for control of automatic circuit-section valves of underground irrigation system.
  - 2. Install control wire with irrigation mains and laterals in common trench where possible. Lay control wire to side of pipe. Provide looped slack at valves, corners, bores and snake wire in trench to allow for contraction. Splices shall be made and placed in control wire splice boxes.
- M. 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 local Plumbing Code. Exposed mainline and mainline risers above PVC pipe main elevation shall be copper. Install one brass union in riser downstream of device.
  - 3. Insulate all above ground piping.

### 3.3 TESTING

- A. General - Notify Landscape Architect 48 hours in advance when testing will be conducted. Conduct tests in presence of Landscape Architect.
- B. Hydrostatic Test - Test irrigation main line, before backfilling trenches, to a hydrostatic pressure of not less than 100 psi for 1 hour. Piping may be tested in sections to expedite work. Remove and repair or replace piping and connections which do not pass hydrostatic testing. System shall not lose more than 1-1/2 gallons of water in 1 hour.
- C. Shut off mainline at backflow preventer during non working hours until Contractor has demonstrated the mainline is stable.
- D. Operational Testing - Perform operational testing after hydrostatic testing is completed, backfill is in place and irrigation heads are adjusted to final position.
  - 1. Demonstrate to Landscape Architect that system meets coverage requirements, is a specified and indicated, and that automatic controls function properly.
  - 2. Coverage requirements are based on operation of one circuit at a time.
  - 3. After completion of grading, sodding and rolling of grass areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than 1/2 inch above finished grade. Set shrub sprinkler heads not more than 1/2 inch above top of mulch.

### 3.4 MAINTENANCE

- A. Contractor shall correctly maintain the irrigation system during the installation process and throughout the landscaping maintenance service period. Specified in Section 329400 - Exterior Landscape Maintenance.
- B. Contractor shall provide "As Built" Drawings for new work, showing dimensioned location of valves, meters, backflow preventers, controllers, and mainline. Contractor shall request reproducible mylars from the Landscape Architect in preparation of "As Built" Drawings.

END OF SECTION 328400

## SECTION 329300 - PLANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Plants.
  - 2. Planting soils.
  - 3. Plant drainage.

#### 1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface adjacent to planting bed.
- C. Prepared Backfill Mix: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Topsoil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- H. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- I. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

- A. Work Schedule: Contractor shall submit a work schedule for all planting work prior to purchase and installation of plant material.
- B. Product Data: For each type of product indicated, including soils.
- C. Samples of backfill mix.
- D. Samples of mulch.
- E. Product certificates.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Including manufacturer's recommendations and instructions recommending procedures to be established by Owner for maintenance of planting work. Submit instructions prior to expiration of Contractor's required maintenance period.

1.4 QUALITY ASSURANCE

- A. Installer: Installation of planting work shall be performed by a single firm specializing in landscape and planting work. Contractor shall be licensed by the Texas Association of Nurserymen, shall possess an agricultural certificate, shall be a licensed pest applicator, and shall have not less than 5 years of experience in this type of work.
- B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 1. Pesticide Applicator: State licensed, commercial.
- C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions or disfigurement.
- D. Delivery, Storage and Handling
  - 1. Compliance: Ship planting materials with Certificates of Inspection as required by governing authorities. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.
  - 2. Substitutions: Do not make substitutions unless approved in writing by Owner's Representative. If specified planting material is not obtainable, submit proof of non-availability to Owner's Representative together with proposal for use of equivalent material. Contractor shall submit proposal in a timely manner as to not impact project completion or installation of other work.
  - 3. Analysis and Standards: All packaged products shall be delivered in original manufacturer's sealed containers. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

4. Inspection: Notify Owner's Representative at least 2 weeks prior to installation, of location where materials that have been selected for planting may be inspected, either at place of growth or the site prior to planting. Plant material will be inspected for compliance with requirements for genus, species, variety, size and quality. Owner's Representative retains right to further inspect trees for size and conditions of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Contractor shall remove rejected trees immediately from site and replace with specified materials. Plant material not installed in accordance with Contract Documents will be rejected.

#### 1.5 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
    - b. Structural failures including plantings falling or blowing over.
  2. Warranty Periods from Date of Substantial Completion:
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    - b. Groundcovers, Biennials, Perennials, and Other Plants: 12 months.
    - c. Annuals: Three months.
  3. Remove and replace trees, shrubs and groundcover found to be dead or in unhealthy condition during warranty period. Replace trees, shrubs and groundcover which are in doubtful condition at end of warranty period. However, if in the opinion of Owner, such doubtful material may survive, Contractor shall extend the warranty period for a full growing season. Owner will determine which items are in doubtful condition.

#### 1.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed throughout the maintenance period. See Section 329301 – Exterior Landscape Maintenance.
  1. Maintenance Period for Trees and Shrubs: 60 days from date of Substantial Completion.
  2. Maintenance Period for Groundcover and Other Plants: 60 days from date of Substantial Completion.
  3. Maintenance Period for New Lawns: 60 days from date of Substantial Completion.

#### 1.7 JOB CONDITIONS

- A. Work Scheduling: Proceed with and complete planting work in a timely manner, working within seasonal limitations for each kind of planting work required.
- B. Planting Time
  - 1. Correlate planting with specified maintenance periods to provide maintenance from date of Substantial Completion.
  - 2. Plant frost-tender trees only after danger of frost is past or sufficiently before frost season to allow for establishment before first frost. Do not plant in frozen ground.
  - 3. Plant trees, shrubs and groundcover after final grades are established and prior to planting of lawns, unless otherwise directed by Owner's Representative in writing. If planting occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- C. Utilities: Refer to drawings and coordinate with Utility Contractor for location of utilities. Contractor shall be responsible for damage to existing utilities and structures.
- D. Security: The Owner will not assume any responsibility for security of any materials, equipment, etc. during construction of the project until project acceptance.
- E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions beyond the scope of this contract, or obstructions, notify Owner's Representative of such conditions, immediately and before planting.
- F. Pollution Control: Control dust caused by planting operations. Dampen surfaces as necessary. Comply with pollution control regulations of governing authorities.

## PART 2 - PRODUCTS

### 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

### 2.2 FERTILIZERS

- A. Fertilizer for planting areas shall be granular fertilizer shall be a commercial fertilizer, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer which has been exposed to high humidity and moisture, has become caked or otherwise damaged making it unsuitable for use, will not be acceptable. Application shall be Osmocote 13.13.13 + Iron by Sierra Chemical, 1-800-492-8255, 1001 Yosemite Dr., Milpitas, CA 95035, or approved equal. Broadcast and rototill fertilizer at the rate of 3 lbs. actual nitrogen per 1000 square feet into prepared planting soil.



- B. Plant tablet shall be Agriform 20-10-5 Planting Tablets shall be evenly placed in planting pits at the following rate:

<u>Material</u>	<u>No. of Tablets</u>
1 gallon/4" pots	1/2 (or granular fertilizer)
5 gallon	1
15 gallon	2
30 gallon	3
Greater than 30 gallon	1 – for each ½ inch

### 2.3 PLANTING SOILS

- A. Prepared Planting Soil Backfill Mix: Shall be "Garden & Flowerbed Mix" as supplied by Nature's Way Resources, Conroe, TX, "Premium Flower, Bed and Garden Soil" as supplied by The Ground Up, Houston, TX, "Soil Mix with Forest Floor Compost" as supplied by LETCO, Houston, TX, or approved equal commercially available soil mix containing sharp sand, compost and topsoil.
- B. Topsoils
1. Provide topsoil which is fertile, friable, natural loam, surface soil, free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension and other extraneous or toxic matter harmful to plant growth.
  2. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches. Topsoil shall not be collected from sites that are infected with growth of, or the reproductive parts of noxious weeds, especially nut grass. Topsoil shall not be stripped, collected or deposited while wet. Topsoil shall not be excessively acid or alkaline or contain toxic substances which may be harmful to plant growth. Topsoil shall be without admixture of subsoil.
- C. Compost Mulch for bed preparation shall be Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants. Mulch shall be composted, well-rotted, blended double-shredded hardwood mulch, black or dark brown in color. Mulch pieces shall be sized to pass through a 1" screen. Compost mulch: Enriched bark mulch for bed prep shall be With additional organic of peat and/or manure. No dyes, mushroom compost or other additives shall be used to artificially enhance the appearance of the level of composting.
- D. Sharp Sand: Sand shall be thoroughly washed, coarse, graded sharp, construction or brick sand, free of clay balls, weeds, and grass. So-called cushion sand, blow sand, or creek silt is not acceptable for substitution where sharp sand is specified.

### 2.4 MULCHES

- A. Mulch for Top Dressing: Shredded hardwood] Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants. Mulch shall be composted, well-rotted, blended double-shredded hardwood mulch, black or dark brown in color. Mulch pieces shall be sized to pass through a 1" screen. No dyes, mushroom compost or other additives shall be used to artificially enhance the appearance of the level of composting. Mulch shall be Native Hardwood Mulch as supplied by Natures Way Resources, 101 Sherbrook Circle, Conroe, TX, or approved equal.

2.5 WEED-CONTROL BARRIERS

- A. Steel Edging: Steel edging shall be 3/16" thick X 4", color: Black, by Ryerson Inc., or approved equal.
- B. Weed Barrier: Woven soil separator/weed barrier to be installed on the path system shall be Pro 5 Weed Barrier as manufactured by DeWitt Company.

2.6 PLANTING DRAINAGE

- A. Drainage Gravel: Drainage gravel shall be 3/4" – 1" diameter clean washed gravel.
- B. Sock Pipe: Sock pipe for drainage in planting areas shall be 4" diameter ADS perforated flex pipe with soil separator cloth.
- C. Gravel for drain field around sock pipe shall be 1/4" - 1/2" diameter smooth washed gravel.
- D. Soil Separator or Filter Fabric shall be Mirafi 140N non-woven geotextile fabric, with permeability minimum 135 gallons of water per min. per square foot or approved equal.

2.7 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.8 HERBICIDE

- A. Pre-emergent herbicide shall be Team Pro as manufactured by Bonus Corp Fertilizer, Houston, TX, or approved equal. Apply pre-emergent over all planting areas prior to spreading mulch at the rate of 7 lbs./1000 sq. feet.
- B. If necessary, contact herbicide shall be Roundup by Monsanto, 800 N. Lindbergh, St. Louis, MO 63167, 314-694-1000, or approved equal. Apply Roundup only if necessary and if approved by owner or owner's representative. Do not exceed manufacturer's recommended rate of application.

2.9 STAKING AND GUYING

- A. Reference drawings for staking and guying material.

### PART 3 - EXECUTION

#### 3.1 PLANTING

##### A. Excavation for Trees and Large Shrubs

1. Excavate pits with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Rough up sides of pit.
2. Make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus 4" allowance for setting of ball on a layer of compacted backfill.
3. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

##### B. Planting Trees and Large Shrubs

1. Set stock on layer of compacted prepared planting soil backfill mix, plumb and in center of pit at same elevation as adjacent finished planting grades. Distribute additional fertilizer evenly throughout backfill mix in hole at specified rate. Place prepared planting soil backfill mix around base and sides of ball and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. For trees, apply Tree Inoculant at rate specified according to size of tree. Repeat watering until no more water is absorbed. Dish top of backfill to allow for mulching.
2. Prune, thin out, and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character. Remove and replace excessively pruned or misformed stock resulting from improper pruning.
3. Stake and guy trees as per the drawings.

##### C. Excavation and Soil Preparation for Shrubs/Groundcovers in Planting Beds

1. Excavate entire planting beds to a depth of 8 inches. Planting beds to have vertical sides.
2. Dispose of subsoil removed from planting beds excavations. Do not mix with planting soil or use as backfill.
3. Till bottom of planter 2"-4", leave bottom of planter un-compacted. Backfill with 8" of prepared backfill mix.

##### D. Planting of Shrubs in Beds

1. Set stock on layer of prepared planting soil backfill mix, plumb and slightly above adjacent finished planting grades. Place additional prepared planting soil backfill mix around base and sides of ball and work each layer to settle backfill and eliminate voids and air pockets. Layer and distribute additional fertilizer in planting hole at specified rate. Water entire bed thoroughly, adjusting plant if settling occurs.

#### 3.2 PLANT MAINTENANCE

- ##### A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations

as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 329300

## SECTION 329301 - EXTERIOR LANDSCAPE MAINTENANCE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and all applicable specification sections, apply to this section.

#### 1.2 WORK COVERED

- A. Furnish all labor, materials and equipment as necessary to provide a landscape maintenance program in strict accordance with the Specifications and Drawings as prepared by Clark Condon Associates.

#### 1.3 RELATED WORK IN OTHER SECTIONS

- A. Examine all section for work related to this section.

#### 1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. Perform Work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all permits required by local authorities.

#### 1.5 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall begin maintenance immediately upon starting any portion of the Work of this contract.
- B. The Contractor's Maintenance Period shall continue 60 days beyond Substantial Completion of all Work in this contract.
- C. Trees, Shrubs and Groundcovers: The Contractor's maintenance of new planting shall consist of watering, cultivating, weeding, mulching, re-staking, tightening and repairing of guys, resetting plants to proper grades or upright position, restoration of the planting saucer, and furnishing and applying such sprays and invigorants as are necessary to keep the plantings free of insects and disease and in thriving condition.
- D. Irrigation System: Maintenance of irrigation system shall consist of monitoring and adjustment of the duration and frequency of the watering schedule, adjustment of heads for coverage and elevation, repair of leaks in both mains and lateral lines and all other work required to establish a complete working irrigation system.
- E. Lawns: Maintenance of new lawns shall consist of mowing, watering, weeding, repair of all erosion and reseeding as necessary to establish a uniform stand of specified grasses.
- F. Trash Pick-up: Pick up trash on site and empty trash receptacles at each site visit.

1.6 PROTECTION

- A. Protect planting areas and lawns at all times against damage of all kinds for duration of maintenance period. Maintenance includes temporary protection fences, barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by Owner at no additional cost to Owner.

1.7 FINAL ACCEPTANCE

- A. Work under this section will be accepted by Landscape Architect upon satisfactory completion of all work, including maintenance, replacement of plant materials and lawns under the Warranty Period. Upon final Acceptance, the Owner will assume responsibility for maintenance of the Work.

1.8 WARRANTIES AND REPLACEMENTS

- A. Refer to other sections.

1.9 MAINTENANCE INSTRUCTIONS

- A. At the completion of work, furnish two (2) copies of written maintenance instructions to Owner and one (1) copy to Landscape Architect for maintenance and care of all planting throughout the year.

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 these Specifications shall be submitted for review by Landscape Architect prior to use.
- C. Topdress Fertilizer: Commercial fertilizer with guaranteed analysis of 16-6-8 or as required for application use. Fertilizer shall have a salt index per nutrient of less than 65.

2.2 REQUIRED EQUIPMENT

- A. Contractor shall have available for their use the following maintenance equipment:
  - 1. Lawn Mowers
  - 2. Gasoline Powered Edgers
  - 3. Trash Collection Equipment
  - 4. Line Trimmers
  - 5. Miscellaneous Hand Tools, Rakes, Brooms, Etc.
  - 6. Blowers
  - 7. Other as needed.

PART 3 - EXECUTION

3.1 WATERING

- A. It shall be the responsibility of the Contractor to assure that the correct watering of plant materials is being accomplished through the following irrigation techniques:
- 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. Frequent watering to the lawn areas to insure against drying. This may be accomplished as above, by the automatic sprinkler system, hand watering or portable sprinklers. Contractor shall monitor settings of automatic sprinkler controls and recommend necessary adjustments according to climatic changes.
- D. Contractor shall be responsible for watering areas within the project limits that do not have irrigation systems.
- E. Contractor shall be responsible for damages to irrigation system caused by maintenance operations.

### 3.2 MAINTENANCE OF TURF AREAS

- A. Mowing lawn/grass areas shall be accomplished with sharp, properly adjusted mowers of the correct size for the various areas.
- B. Mowing frequency shall be as per the Landscape Maintenance Program. Blade heights shall be set according to the following schedule.
  - 1. 1 ½ inches Initial Mowing
  - 2. 1 ½ inches April – November
  - 3. 2 inches December – March
- C. In the event of a prolonged rainy period and a surge of leaf growth is anticipated, the mower height may be readjusted to prevent “scalping” or skinning of lawn on preceding cuts.
- D. Lawn shall be edged evenly at all walks, headers and other structures as per the schedule. Use an edger, not a line trimmer.
- E. Until the establishment of the turf, the Contractor will be responsible for replacing soils that have eroded onto the paved areas. Residual soils on paving will be removed and if not mingled with objectionable materials may be re-used in eroded areas.
- F. Immediately upon observing any lawn grass spreading into shrub or groundcover areas, the Contractor shall initiate a program of removal and maintain this program throughout the maintenance period.
- G. Any lawn grass appearing in paved areas shall receive an application of soil sterilant according to manufacturer’s direction. The sterilant shall be approved and will not be detrimental structurally to paved areas.
- H. Special effort shall be given to the control to fire ants infesting the site. After control is accomplished, the ant mounds shall be lowered and tamped to the existing grade.
- I. Apply top dress fertilizer after grassing, if needed.

3.3 MAINTENANCE OF TREES AND SHRUBS

- A. Contractor shall adjust and tighten as required all tree staking and guying. Removal as directed by Owner's Representative.
- B. All weeds within the mulched area around each tree and in each shrub bed shall be removed as often as required. Under no circumstances shall weeds and grass within planted areas be allowed to attain more than 4 inches growth.
- C. Contractor shall be continuously alert for signs of insect presence or damage or the presence or damage from plant fungi. Upon locating such evidence, the Contractor shall report it to the Owner's Representative and take action as directed.

3.4 MAINTENANCE OF IRRIGATION SYSTEM

- A. Irrigation System: Maintenance of irrigation system shall consist of monitoring and adjustment of the duration and frequency of the watering schedule, adjustment of heads for coverage and elevation, repair of leaks in both mains and lateral lines and all other work required to establish a complete working irrigation system.

3.5 TRASH COLLECTION

- A. Removal of debris from the site unrelated to horticultural maintenance (paper, bottles, can, "Pirate" signs, etc.) shall be the responsibility of the Contractor. Contractor shall pick up trash and empty trash receptacles at each site visit. Frequency as per Landscape Maintenance Program.

3.6 DE-WATERING

- A. Contractor shall de-water by pumping or siphoning as often as necessary to remove excess moisture from soil in planting areas and tree balls. De-watering to occur during scheduled visits as required.

PART 4 - SCHEDULES

- 4.1 THE EXECUTION ITEMS OF PART 3 IN THIS SPECIFICATION SHALL BE PERFORMED AS PER THE FOLLOWING SCHEDULE AS APPLICABLE FOR THE MAINTENANCE PERIOD:

<u>MONTH</u>	<u># OF VISITS PER MONTH</u>
January	2
February	2
March	4
April	4
May	5
June	4
July	5
August	5
September	5
October	3
November	2
December	2



4.2 TOPDRESS FERTILIZER

- A. Thirty (30) days after seeding.

4.3 MULCHING, WEEDING, WEED CONTROL, GUYING AND STAKING ADJUSTMENT

- A. As required at each visit.

4.4 MEETING

- A. Contractor shall meet once each month and at the end of the maintenance period with the Owner's on-site maintenance personnel. Contractor shall review irrigation system schedule and operation and other pertinent and helpful maintenance information at each meeting.

END OF SECTION 329301