

PROJECT MANUAL

Tempe Water Utilities Security and Lighting Upgrades Johnny G. Martinez Plant Tempe, Arizona Tempe Project No. 3203501

Durrant Project No. 10046.00

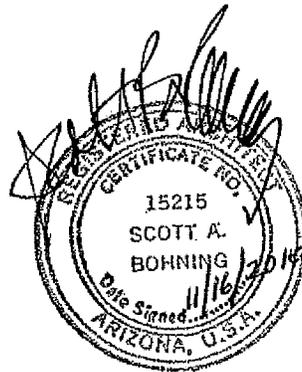
November 16, 2010



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TEMPE WATER UTILITIES
SECURITY AND LIGHTING UPGRADES
JOHNNY G. MARTINEZ PLANT
TEMPE, ARIZONA



EXPIRES 3/31/2014



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**PROJECT MANUAL
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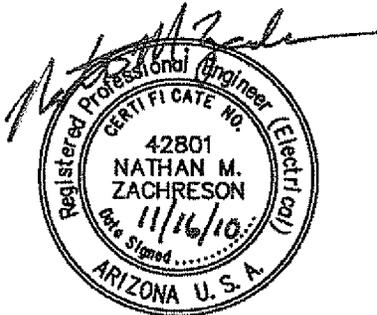
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SECTION 010250 -- MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide Schedule of Values with separately valued items based on subcontractor and Specifications Sections. These will constitute all pay items for completion of Work. No direct or separate payment shall be made for providing miscellaneous temporary or accessory works, plant services, CONTRACTOR'S or ENGINEER'S field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and Record Drawings, water supplies, power, traffic maintenance, removal of waste, watchmen, bonds, insurance, or all other requirements of General Conditions, Supplementary Conditions, and Contract Requirements. Compensation for all such services, items and materials shall be included in prices stipulated for lump sum.
- B. The lump sum price shall be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each Schedule of Values item.

1.2 SCHEDULE OF VALUES

- A. The Schedules of Values is an itemized list that establishes the value or cost of each major part of the Work and the division of Work between CONTRACTOR and subcontractors.
- B. The Schedule of Values shall include all items of Work in the Contract Documents.
- C. The Schedule of Values is a detailed itemized list that establishes the value or cost of each detailed part of the Work. The Schedule of Values may be used as a basis for negotiations, concerning additional work or credits, which may arise during the construction.
- D. Prepare satisfactory Schedule of Values identifying costs of Major Items or Work and other costs. A sample form is included.
 - 1. Schedule of Values:
 - a. Include a breakdown of labor, materials, equipment and other costs. The Schedule shall also show the division of Work between the CONTRACTOR and each of the subcontractors.
 - b. Include an item in the Schedule for City, County and State taxes. The CONTRACTOR may also include cost items for bond, insurance, temporary facilities and mobilization. The CONTRACTOR shall provide supporting data as requested by the ENGINEER for any Schedule item. Each item shall include overhead and profit directly proportioned to the direct cost of that item over the total Contract Cost. The sum of the individual values within the Schedule of Values shall total to the Contract Cost.
 - c. Schedule shall include items for the purchase/delivery costs for each item and material which the CONTRACTOR will request payment prior to installation. The finalized Schedule of Values shall not be approved until the CONTRACTOR has responded to all review comments of the ENGINEER. The CONTRACTOR shall provide supporting data, including certified payrolls, as requested by the ENGINEER for any Schedule item. The CONTRACTOR shall include items for products and systems requested by the ENGINEER. Each item on the Schedule shall include

overhead and profit directly proportional to the direct cost of that item over the total Contract Cost. Sum of individual values within Schedule of Values shall total to Contract Cost.

- d. Assign prices to Major Items of Work which aggregate Contract Price. Base prices on costs associated with scheduled activities for each Major Item of Work.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUBMITTAL

- A. Submit preliminary Schedule of Values no later than 10 days after effective date of Agreement or at Pre-construction Conference, whichever comes first.
- B. Submit finalized Schedule of Values within 20 days following effective date of Notice to Proceed.
- C. Upon request, support prices with data which will substantiate their correctness.

3.2 SAMPLE SCHEDULE OF VALUES

- A. Following is an acceptable form for Schedule of Values.

SCHEDULE OF VALUES

Section No. _____

Sheet _____ of _____

Item Description	Material	Labor	Equipment	Total

END OF SECTION 010250

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project: Tempe Water Utilities
Security and Lighting Upgrades at:

Johnny G. Martinez
255 East Marigold Lane
Tempe, Arizona

1. Architect: Durrant
410 N. 44th Street, Suite 800
Phoenix, AZ 85008

Contact: Chris Allred
Phone: 602 275-6830
Fax: 602 275-4331
callred@durrant.com

2. The Work consists of Lighting and Security Upgrades.

- B. Contract: Single general construction contract.

1.2 USE OF PREMISES

- A. Contractor's use of premises is limited by Owner's right to perform work, to retain other contractors on portions of Project, to provide for security, and to occupy nearby existing facilities during construction of Project.

- B. Contractor's use of premises is limited by:

1. No alcohol is allowed on premises.
2. No smoking is allowed on premises.

1.3 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate Work of this Contract with work performed under separate contracts.

1.4 SPECIFICATION FORMATS AND CONVENTIONS

- A. Drawings, Provisions of Agreement Between Owner and Contractor, General Conditions of the Contract, other Bid Documents, and Division 1 Specification Sections, apply to all Specification Sections.

- B. Specification Format: The Specifications are organized into Divisions and Sections by CSI 49 Division Format and CSI MasterFormat Section Numbering System.
- C. Specification Content:
1. These Specifications contain certain stylistic conventions of language and intended meanings of certain terms, words, and phrases when used in particular situations.
 2. Abbreviated Language:
 - a. Language used in Specifications and other Contract Documents is abbreviated.
 - b. Words implied, but not stated, shall be inferred as the sense requires.
 - c. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as context of Contract Documents indicates.
 3. Imperative mode and streamlined language are generally used in Specifications.
 - a. Requirements expressed in imperative mode are to be performed by Contractor.
 - b. Indicative or subjunctive mode may be used in Section text for clarity to describe responsibilities fulfilled indirectly by Contractor or to explain interacting duties of subcontractors.
 - c. The words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within sentence or phrase.
 4. Words in parentheses after manufacturer's name refer to website on Internet, with www. left out for brevity.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 011000

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections:

1. Section 016000, Product Requirements.

1.2 MINOR CHANGES IN THE WORK

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

1.3 PROPOSAL REQUESTS

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

1. Proposal Requests issued by Architect are for information only. They are not instructions either to stop work in progress or to execute proposed change.
2. After receipt of Proposal Request, submit quotation stating cost adjustments to Contract Sum and Contract Time necessary to execute change.
 - a. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include updated Contractor's Construction Schedule that indicates effect of change (if any), including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of Contract Time.

- B. Contractor-Initiated Proposals: If unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting a change order request.

1. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

3. Include an updated Contractor's Construction Schedule that indicates effect of change (if any), including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of Contract Time.
4. Comply with requirements in Section 016000, Product Requirements, if proposed change requires substitution.

2.2 CHANGE ORDER PROCEDURES

- A. Upon Owner's approval of Proposal Request, Architect will issue Change Order for signatures of Owner and Contractor.

2.3 CONSTRUCTION CHANGE DIRECTIVE

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

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

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

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

PART 2 - PRODUCTS *(Not Applicable)*

PART 3 - EXECUTION *(Not Applicable)*

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections:

1. Section 012600, Contract Modification Procedures.
2. Section 013200, Construction Progress Documentation.

1.2 DEFINITIONS

- A. Schedule of Values: Statement furnished by Contractor allocating portions of Contract Sum to various portions of Work used as basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in Schedule of Values with other required administrative forms and schedules, including:
 - a. Application for Payment forms with Continuation Sheets.
2. Submit Schedule of Values to Architect at earliest possible date but no later than fourteen days before date scheduled for submittal of initial Application for Payment.

- B. Format and Content: Use Project Manual Table of Contents as guide to establish line items for Schedule of Values. Provide at least one line item for each Specification Section.

1. Include this Project identification on Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
2. Arrange Schedule of Values in tabular form with separate columns to indicate for each item listed:
 - a. Description of the Work.
 - b. Name of subcontractor.
 - c. Name of manufacturer or fabricator.
 - d. Name of supplier.

- e. Change Orders that affect value.
 - f. Dollar Value: Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide breakdown of Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual Table of Contents. Provide several line items for principal subcontract amounts, where appropriate.
 4. Round amounts to nearest whole dollar. Total must equal Contract Sum.
 5. Provide separate line item in Schedule of Values for each part of Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing, if required.
 6. Provide separate line items in Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.
 7. Each item in Schedule of Values and Applications for Payment must be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in Schedule of Values or distributed as general overhead expense, at Contractor's option.
 8. Schedule Updating: Update and resubmit Schedule of Values before next Application for Payment when Change Orders or Construction Change Directives result in a change in Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is period indicated in Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets and Yavapai County Application for Payment as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Match entry data to Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit four signed and notarized original copies of each Application for Payment to Architect by method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file mechanic's lien arising out of Contract and related to the Work covered by payment.
1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
 - a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit waivers of lien on forms executed in a manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. List of Contractor's staff assignments.
 5. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 6. Initial progress report.
 7. Certificates of insurance and insurance policies.
 8. Performance and payment bonds.
 9. Data needed to acquire Owner's insurance.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations have been paid.
 3. AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims.
 4. AIA Document G706A, Contractor's Affidavit of Release of Liens.
 5. AIA Document G707, Consent of Surety to Final Payment.
 6. Evidence that claims have been settled.
 7. Final meter readings for utilities and similar data on date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of Work.

PART 2 - PRODUCTS *(Not Applicable)*

PART 3 - EXECUTION *(Not Applicable)*

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative provisions for coordinating construction operations on Project including:
 - a. General project coordination procedures.
 - b. Administrative and supervisory personnel.
 - c. Project meetings.

B. Related Sections:

1. Section 013200, Construction Progress Documentation.
2. Section 017000, Execution Requirements.
3. Section 017700, Closeout Procedures.

1.2 COORDINATION DRAWINGS SUBMITTAL

A. Coordinate construction operations to ensure efficient and orderly installation of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.

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

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

C. Coordination Drawings: Prepare coordination drawings to ensure efficient utilization of space for building components. Coordination drawings will include structural, mechanical, plumbing, fire protection and electrical elements. Provide graphic and written description of any coordination problems that may arise.

1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Content: Project-specific information, drawn accurately to scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable.
 - a. Use applicable Construction Drawings as basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate addition of trade-specific information to coordination drawings by multiple contractors in sequence that best provides for coordination of

information and resolution of conflicts between installed components before submitting for Architect's review.

- c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, plumbing, and electrical systems.
- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during life of installation.
- e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- f. Indicate required installation sequences.
- g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.3 SUBMITTALS

- A. Staff Names: Before starting construction operations, submit list of principal staff assignments, including superintendent and other personnel at Project site. Identify individuals with their duties and responsibilities. List addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in absence of individuals assigned to Project.
 1. Post copies of staff list in Project meeting room in temporary field office, and provide to Owner and Architect.

1.4 PROJECT MEETINGS

- B. General: The Contractor will schedule, conduct, and record meetings at Project site.
 1. Prepare and distribute agenda to all invited attendees.
 2. Record significant discussions and agreements achieved and distribute meeting minutes to everyone concerned.
- C. Preconstruction Conference: Architect and Owner will schedule a preconstruction conference before starting construction, after execution of Agreement. The conference will be held at Project site or other convenient location. The meeting will review responsibilities, personnel assignments and procedures.
 1. Attendees: All participants at conference must be familiar with Project and authorized to make decisions concerning the Work.
 2. Agenda: Items of significance that may affect progress including:
 - a. Tentative construction schedule.
 - b. Critical work sequencing.
 - c. Designation of responsible personnel.
 - d. Procedures for processing Change Orders.
 - e. Procedures for processing Applications for Payment.
 - f. Distribution of Contract Documents.
 - g. Submittal procedures.
 - h. Preparation of Record Documents.
 - i. Use of premises.
 - j. Responsibility for temporary facilities and controls.
 - k. Parking availability.
 - l. Office, work, and storage areas.
 - m. Equipment deliveries and priorities.
 - n. First aid.

- o. Security.
 - p. Progress cleaning.
 - q. Working hours.
- D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity as specified. It is Contractor's responsibility to notify subcontractors, manufacturers, Owner and Architect.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by installation and its coordination with other construction that has preceded or will follow, must attend meeting.
 2. Agenda: Review progress of other construction activities and preparations for particular activity under consideration, including:
 - a. Contract Documents.
 - b. Related Change Orders.
 - c. Purchases.
 - d. Deliveries.
 - e. Submittals.
 - f. Review of mockups.
 - g. Possible conflicts.
 - h. Compatibility problems.
 - i. Time schedules.
 - j. Weather limitations.
 - k. Manufacturer's written recommendations.
 - l. Warranty requirements.
 - m. Temporary facilities and controls.
 - n. Space and access limitations.
 - o. Regulations of authorities having jurisdiction.
 - p. Testing and inspecting requirements.
 - q. Required performance results.
 - r. Protection of construction and personnel.
 3. Record significant discussions, agreements, and disagreements.
 4. Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene conference at earliest feasible date.
- E. Progress Meetings: Contractor will conduct and record progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.
1. Agenda: Review minutes of previous progress meeting. Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since previous meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within Contract Time.
 - b. Review present and future needs including:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.

- 4) Off-site fabrication.
- 5) Temporary facilities and controls.
- 6) Work hours.
- 7) Progress cleaning.
- 8) Quality and work standards.
- 9) Change Orders.
- 10) Documentation of information for payment requests.

2. Reporting: Contractor will distribute minutes of meeting to each party present. Include brief summary of progress since previous meeting and report.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting. Issue revised schedule.

PART 2 - PRODUCTS *(Not Applicable)*

PART 3 - EXECUTION *(Not Applicable)*

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for documenting progress of construction during performance of Work, including:
 - a. Preliminary construction schedule.
 - b. Contractor's construction schedule.
 - c. Digital photographs.
- B. Related Sections:
 - 1. Section 013300, Submittal Procedures.
 - 2. Section 014000, Quality Requirements.
 - 3. Section 017700, Closeout Procedures.

1.2 SUBMITTALS

- A. Preliminary Construction Schedule: Submit six printed copies.
- B. Contractor's Construction Schedule: Submit three printed copies of initial schedule large enough to show entire schedule for entire construction period.
- C. Digital Photographs: Submit electronic files via e-mail of each photograph. Provide digital images in JPEG format with minimum sensor size of 1.3 megapixels.

1.3 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, progress reports, payment requests, and other required schedules and reports.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date does not change by submitting schedule that shows early completion date, unless specifically authorized by Change Order.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updates: At project meetings, update schedule to reflect actual construction progress and activities.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Owner, testing and inspecting agencies, and other parties identified by Contractor with schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for submitting Shop Drawings, Product Data, and other Submittals.

B. Related Sections:

1. Section 013200, Construction Progress Documentation.
2. Section 014000, Quality Requirements.
3. Section 017700, Closeout Procedures.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's response.

B. Informational Submittals: Written information that does not require Architect's response.

1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3. All Product Data, Shop Drawings, Samples and other items for a Specification Section must be submitted at one time.

B. Processing Time: Allow adequate time for submittal review, including time for resubmittals, as follows.

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.
3. If intermediate submittal is necessary, process in same manner as initial submittal.
4. Allow 14 days for processing each resubmittal.

5. No extension of Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
 6. All submittals must be delivered to Durrant's Phoenix office and signed for, before review time begins. Deliver some samples to Project site, as directed by Architect.
- C. Identification: Place permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 by 10 inches on label or beside title block to record Contractor's, Architect's and Consultant's review stamps.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Unique identifier, including revision number.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Other necessary identification.
- D. Deviations: Highlight, encircle, or otherwise specifically identify deviations from Contract Documents in submittals. If this is not done, all deviations are solely responsibility of Contractor.
- E. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form. Architect will not review submittals received from sources other than Contractor.
1. On attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of Contract Documents, including minor variations and limitations. Include same label information as related submittal.
 2. Include Contractor's certification stating that information submitted complies with requirements of Contract Documents.
 3. Transmittal Form required for information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Submittal and transmittal distribution record.
 - i. Remarks.
 - j. Signature and printed name of transmitter.
- F. Use for Construction: Use only submittals with mark indicating action taken by Architect in connection with construction.
- G. Provide minimum six (6) copies of all submittals.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
 - a. Initial Submittal: Submit six copies of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect will return submittal with options selected.
 - b. Final Submittal: Submit six copies. Retain one returned copy as a Project Record Document.

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

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operating and maintenance manuals.
 - k. Compliance with recognized trade association standards.
 - l. Compliance with recognized testing agency standards.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of Contract Documents or standard printed data.

1. Preparation: Include the following information as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
 4. Number of Copies: Submit copies of each submittal, as follows:
 - a. Initial Submittal: Submit six blackline prints.
 - b. Final Submittal: Submit six blackline prints. Retain one returned print as Project Record Drawing.
- D. Schedule of Values: Comply with requirements in Section 012900.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit informational submittals required by other Specification Sections.
1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated.
 2. Certificates and Certifications: Provide notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements in Section 014000.
- B. Contractor's Construction Schedule: Comply with requirements in Section 013200.
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that installer complies with requirements and, where required, is authorized for this specific Project.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- G. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with Specifications. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by qualified testing agency.
- H. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Section 017700.
- I. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.

2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- J. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of coverage.
- K. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal for compliance with Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Submittals not required by Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Documents. Owner will pay for all materials testing and special inspections required by Contract Documents, and International Building Code.
1. Quality-control requirements for individual construction activities are specified in individual Sections (e.g., Section 033000, Cast in Place Concrete). Requirements in those Sections may also cover production of standard products.
 2. Specified tests, inspections, and related actions do not limit or replace Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
 3. The requirements for structural special inspections are indicated in General Structural Notes in Drawings.
 4. The requirements for mechanical special inspections are indicated in Mechanical Specifications.
- C. Related Sections:
1. Section 013200, Construction Progress Documentation.

1.2 DEFINITIONS

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with Specifications.
- B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with Specifications. Services do not include contract enforcement activities performed by Architect.
- C. Testing Agency: An independent agency engaged to perform materials tests, special inspections, or both.

1.3 DELEGATED DESIGN

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

1.4 SUBMITTALS

- A. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- B. Schedule of Required Tests: Prepare in tabular form and include the following:
1. Specification Section number and title.
 2. Description of test and inspection.
 3. Identification of applicable standards.
 4. Identification of test and inspection methods.
 5. Number of tests and inspections required.
 6. Time schedule or time span for tests and inspections.
 7. Entity responsible for performing tests and inspections.
 8. Requirements for obtaining samples.
- C. Reports: The testing agencies prepare and submit certified written reports that include:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Ambient conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- D. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer licensed in Arizona, who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of system, assembly, or product that is similar to those indicated for this Project in material, design, and extent.
 - 1. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Owner, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from Contract Documents.
- F. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with experience and capability to conduct testing, and inspections indicated, as documented according to ASTM E 548. Additional qualifications are specified in individual Sections.
 - 1. **NRTL:** A nationally recognized testing laboratory according to 29 DFR 1910.7.
 - 2. **NVLAP:** A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.6 QUALITY CONTROL

- A. **Contractor Responsibilities:**
 - 1. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or special inspections will be performed.
- B. **Special Tests and Inspections:** Engage testing agency to conduct tests and special inspections required by authorities having jurisdiction, by Contract Documents, and by International Building Code.
 - 1. Testing agency will notify Architect, Owner and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 2. Testing agency will submit a certified written report of each test, inspection, and similar quality control service to Architect, Owner, and Contractor.
 - 3. Testing agency will submit a final report of material tests and special inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from Contract Documents.
 - 5. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from Contract Documents.
 - 6. Testing agency will retest and reinspect corrected work.
- D. **Retesting/Reinspecting:** Provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by Contract Documents.
- E. **Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:**
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field-curing of test samples.

5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. Schedule of Tests and Special Inspections: Prepare a schedule of tests, special inspections, and similar quality control services required by Contract Documents. Submit schedule within 30 days of Notice to Proceed. Distribute schedule to Owner, Architect, and each party involved in performance of Work where tests and special inspections are required.

PART 2 - PRODUCTS *(Not Applicable)*

PART 3 – EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspections, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- B. Protect construction exposed by or for quality control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS AND ORGANIZATIONS

- A. **Applicability of Standards:** Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.
- B. **Publication Dates:** Comply with standards in effect on date of Contract Documents.
- C. **Conflicting Requirements:** Where compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quantity or quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for decision before proceeding.
 - 1. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified is minimum to be provided or performed. Actual installation may exceed minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for context of requirements. Refer uncertainties to Architect for decision before proceeding.
- D. **Copies of Standards:** Contractors engaged in construction on Project must be familiar with industry standards applicable to construction activity. Copies of applicable standards are not bound with Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make available on request.
- E. **Abbreviations and Names:** Abbreviations and acronyms are frequently used in Specifications and other Contract Documents to represent name of trade association, standards-developing organization, authority having jurisdiction, or other entity in context of referencing a standard or publication. The following abbreviations and acronyms, as referenced in Contract Documents, refer to associated names. Refer to Gale Research "Encyclopedia of Associations" or Columbia Books "National Trade & Professional Associations of U.S.," for those not listed.

AAMA	American Architectural Manufacturers Association www.aamanet.org
ACI	American Concrete Institute www.aci-int.org
ADAAG	Americans with Disabilities Act Accessibility Guidelines www.access-board.gov

AFPA	American Forest and Paper Association www.afandpa.org
AI	Asphalt Institute www.asphaltinstitute.org
AIA	The American Institute of Architects www.aia.org
AISC	American Institute of Steel Construction www.aisc.web.com
AISI	American Iron and Steel Institute www.steel.org
AITC	American Institute of Timber Construction www.aitc-glulam.org
ALSC	American Lumber Standards Committee www/alsc.org
ANSI	American National Standards Institute www.ansi.org
APA	APA-The Engineered Wood Association www.apawood.org
APA	Architectural Precast Association www.archprecast.org
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers www.ashrae.org
ASLA	American Society of Landscape Architects www.asla.org
ASME	American Society of Mechanical Engineers www.asme.org
ASTM	American Society for Testing and Materials www.astm.org
AWI	Architectural Woodwork Institute www.awinet.org
AWS	American Welding Society www.amweld.org
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com
BIA	Brick Industry Association www.bia.org

CRSI	Concrete Reinforcing Steel Institute www.crsi.org
DHI	Door and Hardware Institute www.dhi.org
EIMA	EIFS Industry Members Association www.eifsfacts.com
EPA	Environmental Protection Agency www.epa.gov
FMG	FM Global (Factory Mutual) www.fmglobal.com
GA	Gypsum Association www.usg.com
GANA	Glass Association of North America www.glasswebsite.com/gana
IEEE	Institute of Electrical and Electronics Engineers www.ieee.org
ICC	International Code Council www.iccsafe.org
LEED	Leadership in Energy and Environmental Design www.usgbc.org
MAG	Maricopa Association of Governments www.mag.maricopa.gov
NAAMM	National Association of Architectural Metal Manufacturers www.gss.net/naamm
NCMA	National Concrete Masonry Association www.ncma.org
NEMA	National Electrical Manufacturers Association www.nema.org
NFPA	National Fire Protection Association www.nfpa.org
NHLA	National Hardwood Lumber Association www.natlhardwood.org
NIST	National Institute of Standards and Technology www.nist.gov
NRCA	National Roofing Contractors Association

	www.roofonline.org
OSHA	Occupational Safety and Health Administration www.osha.gov
PCA	Portland Cement Association www.portcement.org
PCI	Precast/Prestressed Concrete Institute www.pci.org
PDCA	Painting and Decorating Contractors of America www.pdca.org
SDI	Steel Door Institute www.steeldoor.org
SJI	Steel Joist Institute www.steeljoist.org
TCNA	Tile Council of North America www.tileusa.com
UL	Underwriters Laboratories Inc. www.ul.com
USGBC	United States Green Building Council www.usgbc.org
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org
WCSC	Window Covering Safety Council www.windowcoverings.org
WWPA	Western Wood Products Association www.wwpa.org

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Requirements for temporary facilities and controls:
 - a. Temporary utilities.
 - b. Support facilities.
 - c. Security and protection facilities.
 - d. Dust control.

B. Temporary utilities include, but are not limited to:

1. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.

C. Support facilities include, but are not limited to:

1. Waste disposal facilities.
2. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to:

1. Environmental protection.
2. Stormwater control.
3. Barricades, warning signs, and lights.

E. Related Sections:

1. Section 013300, Submittal Procedures.
2. Section 017000, Execution Requirements.
3. Section 017700, Closeout Procedures.

1.2 QUALITY ASSURANCE

A. Standards:

1. Comply with following:
 - a. ANSI A10.6 - "Safety Requirements for Demolition."
 - b. NECA - "Temporary Electrical Facilities."
 - c. NFPA 241 - "Standard for Safeguarding Construction, Alteration, and Demolition Operations."

1.3 PROJECT CONDITIONS

A. Temporary Utilities:

1. At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
2. Temporary Use of Permanent Facilities:
 - a. Installer of each permanent service assumes responsibility for operation, maintenance, and protection of permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use:

1. The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - a. Keep temporary services and facilities clean and neat.
 - b. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide new materials.
2. Undamaged, previously used materials in serviceable condition may be used if approved by Architect.
3. Provide materials suitable for use intended.

B. Water: Potable.

2.2 EQUIPMENT

A. General:

1. Provide equipment suitable for intended use.

B. Fire Extinguishers:

1. Portable, UL rated.
2. Comply with NFPA 10 and NFPA 241.

C. Self-Contained Toilet Units:

1. Single-occupant units of chemical, aerated recirculation, vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking Water Fixtures:

1. Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work.
 - 1. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay.
 - 1. Maintain and modify as required.
 - 2. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Sanitary Facilities:
 - 1. Provide temporary toilets, wash facilities, and drinking water.
 - 2. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 3. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 - 4. Wash Facilities:
 - a. Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
 - 5. Drinking Water Facilities:
 - a. Provide bottled water or drinking water units.
 - 6. Locate toilets and drinking water fixtures so personnel need not walk more than 400 feet to facilities.

3.3 SUPPORT FACILITIES INSTALLATION

- A. Waste Disposal Facilities:
 - 1. Provide waste collection containers in sizes adequate to handle waste from construction operations.
 - 2. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
 - 3. Comply with Section 017000, Execution Requirements, for progress cleaning requirements.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection:

1. Provide protection, operate temporary facilities, and conduct construction by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise.
2. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
3. Dust Control: Comply with all regulations of the Arizona Department of Environmental Quality and all Yavapai County and local regulations.

B. Stormwater Control:

1. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

C. Barricades, Warning Signs, and Lights:

1. Comply with standards and code requirements for erecting structurally adequate barricades.
2. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for:
 - a. Selection of products for use in Project.
 - b. Product delivery, storage, and handling.
 - c. Manufacturers' standard warranties on products.
 - d. Special warranties.
 - e. After-bid product substitutions and comparable products.

B. Related Sections:

1. Section 014200, References.
2. Section 017700, Closeout Procedures.

1.2 DEFINITIONS

A. Products:

1. Items purchased for incorporating into the Work.
2. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
3. Named Products:
 - a. Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature.
4. New Products:
 - a. Items not previously incorporated into another project or facility.
 - b. Products salvaged or recycled from other projects are not new products and their use is prohibited, unless requested by Owner.
5. Comparable Product:
 - a. Product that is demonstrated through submittal process to have indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification:

1. Where a specific manufacturer's product is named and accompanied by words "basis of design."
2. Make or model number or other designation is to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance

and other characteristics for purposes of evaluating comparable products of other named manufacturers.

C. Manufacturer's Warranty:

1. Preprinted standard written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

D. Special Warranty:

1. Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

E. Minimum Warranty:

1. For all products and installation, two years from date of Substantial Completion.

1.3 QUALITY ASSURANCE

A. Compatibility of Options:

1. If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
2. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Comply with manufacturer's written instructions.
2. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
3. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
4. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
5. Inspect products on delivery to ensure compliance with Contract Documents and to ensure products are undamaged and properly protected.
6. Store products to allow for observation and measurement of quantity or counting of units.
7. Store products subject to damage by elements in weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

1.5 PRODUCT WARRANTIES

A. Warranties specified in other Sections are in addition to, and run concurrent with, other warranties required by Contract Documents.

1. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

B. Special Warranties:

1. Prepare a written document that contains appropriate terms and identification, ready for execution.
2. Submit a draft for approval before final execution.
3. Provide manufacturer's standard form: Modified to include Project-specific information, and properly executed.

C. Submittal Time:

1. Comply with requirements in Section 017700, Closeout Procedures.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements:

1. Provide products that comply with Contract Documents, and are undamaged and new at time of installation.
2. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation.
3. Standard Products: Unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
4. Owner reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
5. Where products are accompanied by term "as selected," Architect will make selection.

B. Product Selection Procedures:

1. Product:
 - a. Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide product named.
2. Manufacturer:
 - a. Where Specification paragraphs or subparagraphs titled "Manufacturer" name single sources, provide a product by manufacturer named that complies with Specifications.
3. Products:
 - a. Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of products listed

that complies with Specifications.

4. Or Equal:
 - a. Where products are specified by name and accompanied by term "or equal" or "approved equal" comply with "Compatible Products" Article to obtain approval for use of an unnamed product.
5. Manufacturers:
 - a. Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with Specifications.
6. Visual Matching Specification:
 - a. Where Specifications require matching an established Sample, select a product and manufacturer that complies with requirements and matches Architect's sample.
 - b. Architect's decision is final on whether a proposed product matches satisfactorily.
7. Basis of Design Products:
 - a. When Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics based on the product named. Comply with provisions in Comparable Products article for consideration of an unnamed product by the other named manufacturer.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within 60 days after Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and submitted in compliance with Section 013300, Submittal Procedures.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.

10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
 6. Comparable product submittal is fully documented and submitted in compliance with Section 013300, Submittal Procedures.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 016000

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General procedural requirements governing execution of Work:
 - a. General installation of products.
 - b. Progress cleaning.
 - c. Protection of installed construction.
 - d. Correction of Work.

B. Related Sections:

1. Section 013300, Submittal Procedures.
2. Section 017700, Closeout Procedures.

PART 2 - PRODUCTS *(Not Applicable)*

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions:

1. The existence and location of site improvements, underground and other utilities, and other construction indicated as existing are not guaranteed.
2. Before beginning work, investigate and verify existence and location of underground utilities, mechanical and electrical systems and other construction affecting Work. Before construction verify location and invert elevation at points of connection of sanitary sewer, storm sewer, water supply; and underground electrical services.
3. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions:

1. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations
2. Where a written report listing conditions detrimental to performance of Work is required by other Sections, include:
 - a. Description of Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
3. Proceed with installation only after unsatisfactory conditions have been corrected.
4. Proceeding with Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information:

1. Furnish information to Owner necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility equipment located in or affected by construction.
2. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions:

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted and only after arranging to provide temporary utility services.
 - a. Notify Architect and Owner three days in advance of proposed utility interruptions.
 - b. Do not proceed with utility interruptions without Owner's written permission.

C. Field Measurements:

1. Take field measurements as required.
2. Recheck measurements before installing each product.
3. Where portions of Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
4. Coordinate fabrication schedule with construction progress to avoid delaying Work.

D. Space Requirements:

1. Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions:

1. Immediately upon discovery of need for clarification of Contract Documents, submit a request for information to Architect. Include detailed description of problem encountered, together with recommendations.

3.3 CONSTRUCTION LAYOUT

A. Verification:

1. Before proceeding to lay out Work, verify layout information shown on Drawings, in relation to property survey and existing benchmarks.
2. If discrepancies are discovered, notify Architect promptly.

B. General:

1. Engage land surveyor registered in Arizona to lay out Work using accepted surveying practices.
2. Establish benchmarks and control points to set lines and levels as needed to locate each element of Project.
3. Establish dimensions within tolerances indicated.
4. Do not scale Drawings to obtain required dimensions.
5. Check location, level and plumb, of every major element as Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

C. Site Improvements:

1. Locate and lay out site improvements, including pavements, grading, fill, topsoil, utility slopes, and invert elevations.

3.4 FIELD ENGINEERING

A. Reference Points:

1. Locate existing permanent benchmarks, control points, and similar reference points before beginning Work.
2. Preserve and protect permanent benchmarks and control points during construction operations.
3. Do not change or relocate existing benchmarks or control points.
4. Report lost or destroyed permanent benchmarks or control points promptly.
5. Report need to relocate permanent benchmarks or control points to Architect before proceeding.
6. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on original survey control points.

B. Benchmarks:

1. Establish and maintain minimum of two permanent benchmarks on Project site, referenced to data established by survey control points.
2. Comply with authorities having jurisdiction for type and size of benchmark.
3. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
4. Where actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate Work.
5. Remove temporary reference points when no longer needed.
6. Restore marked construction to original condition.

3.5 INSTALLATION

A. General:

1. Locate components of Work accurately, in correct alignment and elevation, as indicated.
2. Make vertical work plumb and make horizontal work level.
3. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at time and under conditions that will ensure the best possible results.

1. Maintain conditions required for product performance until Substantial Completion.

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

E. Tools and Equipment:

1. Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners:

1. Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of Work.
2. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
3. Allow for building movement, including thermal expansion and contraction.

G. Joints:

1. Make joints of uniform width.
2. Where joint locations in exposed work are not indicated, arrange joints for best visual effect, subject to Architect's approval.
3. Fit exposed connections together to form hairline joints.

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

3.6 PROGRESS CLEANING

A. General:

1. Maintain Project site free of waste materials and debris.
 - a. Clean Project site and work areas daily, including common areas.
2. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
3. Enforce requirements strictly.
4. Dispose of materials lawfully.
5. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
6. Do not hold materials more than seven days during normal weather or three days if temperature is expected to rise above 80° F.
7. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Work Areas:

1. Clean areas where work is in progress to level of cleanliness necessary for proper execution of Work.
2. Remove liquid spills promptly.

C. Installed Work:

1. Keep installed work clean.
2. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed.
3. Use only cleaning materials specifically recommended.
4. Use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

D. Exposed Surfaces:

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- E. Waste Disposal:
 - 1. Burying or burning waste materials on-site is prohibited.
 - 2. Washing waste materials down sewers or into waterways is prohibited.
- F. Clean and protect construction in progress and adjoining materials already in place.
 - 1. Apply protective covering where required to protect Work from damage or deterioration.
- G. Clean and provide maintenance on completed construction as necessary for remainder of construction period.
- H. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures:
 - 1. Supervise construction operations to assure that no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions to ensure installed Work is undamaged and without deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF WORK

- A. Repair or remove and replace defective construction. Repairing Includes:
 - 1. Replacing defective parts.
 - 2. Refinishing damaged surfaces.
 - 3. Touching up with matching materials.
 - 4. Properly adjusting operating equipment.
- B. Remove and replace damaged surfaces exposed to view if surfaces cannot be repaired.

END OF SECTION 017000

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for contract closeout, including:
 1. Substantial and Final Completion.
 2. Project Record Documents.
 3. Operation and Maintenance Manuals.
 4. Warranties.
 5. Final Cleaning.

B. Related Sections:

1. Section 013200, Construction Progress Documentation.

1.2 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside limits of construction.

1. Organize list of spaces in sequence.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. For each incomplete item, indicating action that will be taken to complete construction.
4. Include at top of each page Project name, date, name of Contractor and page number.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting site visit to determine Substantial Completion, complete the following:

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
6. Terminate and remove temporary facilities from Project site, along with construction tools and similar elements.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
8. Complete final cleaning requirements, including touchup painting.

9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Substantial Completion: Submit a written request for site visit to determine Substantial Completion. List items that are incomplete. On receipt of request, Architect will either proceed with review or notify Contractor of unfulfilled requirements. Architect will prepare Certificate of Substantial Completion or will notify Contractor of items (either on Contractor's punchlist or additional items identified by Architect or Owner) that must be completed or corrected before certificate will be issued.
1. Second Review: Request when Work identified in previous review as incomplete is completed or corrected. The Architect and Consultants will do a total of two reviews only.
 2. Results of completed review will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final review to determine date of Final Completion, complete the following:
1. Prepare and submit Project Record Documents, Operation and Maintenance Manuals, damage or settlement surveys, and similar final record information.
 2. Submit final Application for Payment according to Section 012900, Payment Procedures.
 3. Submit certified copy of Contractor's Substantial Completion list of items to be completed or corrected (punch list). State that each item has been completed or otherwise resolved for acceptance.
 4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Final Completion: Submit a written request for site visit to determine Final Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Second Review: Request when Work identified in previous review as incomplete is completed or corrected. The Architect and Consultants will do a total of two reviews only.

1.5 PROJECT RECORD DOCUMENTS

- A. General: Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference.
- B. Record Drawings: Maintain and submit one set of prints of Contract Documents and Shop Drawings.
1. Mark Record Drawings to show actual installation where installation varies from Contract Documents.
 1. Accurately record information in an understandable drawing technique.
 2. Record data as soon as possible after obtaining it. Record and check markup before enclosing concealed installations.

3. Mark Contract Documents or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Documents.
 - e. Mark Record Drawings with pencil dark enough to reproduce.
2. Note Construction Change Directive numbers, Change Order numbers, Allowance Order numbers and similar identification where applicable.
 3. Identify and date each Record Drawing. Include designation "PROJECT RECORD DRAWING," in ½" high letters. Provide names, addresses, and phone numbers of General Contractor and appropriate subcontractor in prominent location on each sheet. The Architect will review a print set of Contractor's original Record Drawing set for accuracy and completeness. This set will be returned to Contractor for correction. Make corrections and then provide original complete set of Record Drawings on 3 mil mylar, and five blackline print sets to Architect for Owner.
- C. Electronic Format Record Drawings: Maintain and submit electronic CAD file Record Drawings. The Architect will provide to the Contractor a complete set of Contract Documents (Bid Set) in electronic file form (Autocad format). The Contractor must edit these files to record all items shown on paper Record Drawings and to include all RFI responses, Change Orders and clarifications. Plot set of Record Drawings from edited electronic files. The Architect will review Record Drawings set and return to Contractor. After making any required corrections, provide complete set of final Record Drawings on 3 mil mylar and five blackline print sets as well as three sets of electronic files in CD format.
- D. Record Specifications: Submit one copy of Project Specifications in 3-ring binder. Include all Addenda and Contract modifications such as RFI's, Proposal Requests and Change Orders. Mark copy to indicate actual product installation where installation varies from that indicated in Specifications, addenda, and Contract modifications. The Architect will review Record Specifications for accuracy and completeness, and return to Contractor for correction. Make correction and provide five Record Specification sets to Architect for Owner.
- E. Record Product Data: Submit one copy of each Product Data submittal.
1. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 2. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.
- F. Miscellaneous Record Submittals: Assemble records required by other Specification Sections for record keeping and submittal in connection with performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. For review, provide one complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and other equipment. Organize manuals into sets of manageable size. Bind and index data into heavy duty three-ring binder. Include operation and maintenance data required in individual Specification Sections and as follows:
1. Operation Data:
 1. Emergency instructions and procedures.
 2. System, subsystem, and equipment descriptions, including operating standards.
 3. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 4. Description of controls and sequence of operations.

2. Maintenance Data:

1. Manufacturer's information, including list of spare parts.
2. Name, address, and telephone number of installer, supplier and subcontractor.
3. Maintenance procedures.
4. Maintenance and service schedules for preventive and routine maintenance.
5. Maintenance record forms.
6. Sources of spare parts and maintenance materials.
7. Copies of maintenance service agreements.
8. Copies of warranties and bonds.

- B. After review by Architect and Engineers, provide four corrected sets of complete Operation and Maintenance Manuals to Architect for Owner. Identify each binder on front and spine with printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and name of Contractor.

1.7 WARRANTIES

- A. All warranties must be written for minimum two years from date of Substantial Completion.
- B. Submittal Time: Submit written warranties for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated.
- C. Organize warranty documents into orderly sequence based on Table of Contents in Project Manual.
1. Bind one set of warranties and bonds in heavy-duty, 3-ring, binder, in size necessary to accommodate contents, for 8-1/2-by-11-inch paper. Architect will review and return to Contractor with comments. Contractor will then make corrections and submit five sets of warranty binders to Architect for Owner.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product and name, address, and telephone number of installer.
 3. Identify each binder on front and spine with printed title "WARRANTIES," Project name, and name of Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned and which are compatible with cleaning agents used by Owner's maintenance personnel. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.
- B. Cleaning: Complete the following cleaning operations before requesting observation for certification of Substantial Completion for entire Project:
 - 1. Clean Project site in areas disturbed by construction activities, including landscape areas, of rubbish, waste material, litter, and other foreign substances.
 - 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - 3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 4. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - 5. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces.
 - 6. Remove labels that are not permanent.
 - 7. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 8. Wipe surfaces of electrical equipment. Remove excess lubrication, and other foreign substances. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - 9. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out lamps.
 - 10. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 033000 – CAST IN PLACE CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast in place concrete.
 - 2. Formwork.
 - 3. Reinforcement.
 - 4. Concrete materials.
 - 5. Mix design.
 - 6. Placement procedures.
 - 7. Finishes.

1.2 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, supports and reinforcement required for openings through concrete.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Material Test Reports: From qualified testing agency indicating and interpreting test results for compliance with Specifications based on comprehensive testing of current materials for:
 - 1. Cementitious materials and aggregates
 - 2. Steel reinforcement and reinforcement accessories
 - 3. Admixtures
 - 4. Bonding agents
 - 5. Adhesives

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct testing indicated, as documented according to ASTM E 548.
- B. Source Limitations: Obtain each type or class of cementitious material of same brand from same manufacturer's plant, each aggregate from one source, and each admixture from same manufacturer.
- C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

- D. ACI Publications: Comply with:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 – PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1, or better.
 - b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- C. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless steel bar supports.
- B. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
- B. Normal Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Negligible weathering region, but not less than 1N.
 - 2. Nominal Maximum Aggregate Size: 1" (3/4" for concrete topping at composite deck).
- C. Water: Potable and complying with ASTM C 94.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Subject to compliance with Specifications, these products may be submitted:
 - 1. Spray-Film by ChemMasters.
 - 2. Aquafilm by Dayton Superior
 - 3. Sure Film by Dayton Superior.
 - 4. E-Con by L&M Construction.
 - 5. Sealtight Evapre by W. R. Meadows.
 - 6. Sika Film by Sika Corporation.
- B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound:
 - 1. Vocomp 20 by W.R. Meadows, or approved equal.

2.5 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data according to ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for laboratory trial mix basis.
- C. Cementitious Materials: Portland cement.
- D. Do not air entrain concrete at trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- E. Admixtures:
 - 1. Do not use admixtures without Engineer's review and approval.
 - 2. Contractor retains full responsibility for performance of admixtures.

2.6 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI "Manual of Standard Practice."

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes or less.

PART 3 – EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Shop or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form from plastic keyway section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify installation of embedded items is complete and required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Place concrete to avoid segregation.

- D. Deposit concrete in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 2. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than visible effectiveness of vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Cold Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg. F for three successive days, maintain delivered concrete mixture temperature within temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 - 2. Fog spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height. Conform to finish requirements established by approved mockup.
 - 1. Apply to concrete surfaces exposed to view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth formed finish.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed 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.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

3.14 CONCRETE SURFACE REPAIRS.

- A. Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Use dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing No. 16 sieve, with only enough water for handling and placing.
- B. Repair Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on surface, stains, and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½ inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect. Prepare, mix and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, and level surface. Feather edges to match adjacent floor elevations.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent testing agency will sample materials, perform tests, and submit test reports during concrete placement. Quality control includes all tests listed in this Specification.
- B. Testing Services: Perform testing of composite samples of fresh concrete obtained according to ASTM C 172 and according to the following requirements:
 - 1. Testing Frequency: Obtain 3 cylinders for each day's placement of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd. A qualified testing laboratory shall test one cylinder at seven days and two at 28 days.

- a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mix, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: Comply with ASTM C 143, one test at point of placement for each composite sample, but not less than one test for each day's placement of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: Comply with ASTM C 231, pressure method, for normal-weight concrete. Perform one test for each composite sample, but not less than one test for each day's placement of each concrete mix.
4. Concrete Temperature: Comply with ASTM C 1064, one test hourly when air temperature is 40° F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: Comply with ASTM C 31/C 31M, cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample. Standard cylinders are 6" x 12".
6. Compressive-Strength Tests: Comply with ASTM C 39.
 - a. Test two field-cured specimens at seven days and two at 28 days.
 - b. Compressive-strength is average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mix is satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 200 psi.
9. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Include Project identification name and number, date of concrete placement, name of concrete testing agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven and 28-day tests.
10. Additional Tests: Testing agency will make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed by Architect. Contractor pays for all additional tests required.
11. Additional testing and inspection at Contractor's expense will be performed to determine compliance of replaced or additional work with Specifications. Correct deficiencies in Work that test reports and inspections indicate does not comply with Contract Documents.

END OF SECTION 033000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Steel gate framing and posts.

1.2 SUBMITTALS

- A. Shop Drawings:
1. Plans, elevations, sections, and details of metal fabrications.
 2. Show anchorage and accessory items.

1.3 QUALITY ASSURANCE

- A. Welding:
1. Conform to requirements of following:
 - a. AWS D1.1, "Structural Welding Code--Steel."
 - b. AWS D1.3, "Structural Welding Code--Sheet Steel."
 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes performed, and has valid licenses, if required.

1.4 PROJECT CONDITIONS

- A. Field Measurements:
1. Coordinate fabrication schedule with construction progress to avoid delaying Work.

1.5 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications.
- B. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- C. Deliver such items to site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General:

1. For metal fabrications exposed to view in completed Work, provide materials with smooth flat surfaces without blemishes.
2. Do not use materials with exposed pitting, seam marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40).

D. Cast in Place Anchors in Concrete:

1. Anchors of type indicated below, fabricated from corrosion resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
2. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel.
3. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

E. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal to be welded.

2.3 FASTENERS

A. General:

1. Provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls.
2. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Plain Washers: Round, carbon steel, ASME B18.22.1.

G. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

H. Expansion Anchors:

1. Anchor bolt and sleeve assembly of material indicated.
 2. Capability to sustain, without failure, a load equal to six times load imposed when installed in unit masonry and four times the load imposed when installed in concrete, when tested in accordance with ASTM E 488.
 3. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 4. Material: Stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout:

1. Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
2. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly:

1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.
2. Disassemble units only as necessary for shipping and handling limitations.
3. Use connections that maintain structural value of joined pieces.
4. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately; remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously.

1. Comply with following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure.

1. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Allow for thermal movement resulting from the following maximum change in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Base engineering calculation on surface temperature of materials due to both solar heat gain and nighttime-sky heat loss.
 - 2. Temperature Change: 120° F, ambient; 180° F, material surfaces.
- I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- J. Remove sharp or rough areas on exposed traffic surfaces.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts.
 - 2. Locate joints where least conspicuous.
- L. Provide all steel imbed plates for concrete and masonry indicated on Drawings.

2.6 STEEL GATES

- A. General: Provide steel framing and posts as necessary to complete Work.
- B. Fabrication:
 - 1. Fabricate units from structural steel shapes, plates, and bars of welded construction, unless otherwise indicated.
 - 2. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Hot dip galvanized posts and entire gate after completion of welding.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement:
 - 1. Perform cutting, drilling, and fitting required for installing metal fabrications.

2. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form hairline joints.
1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.\
- D. Field Welding:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns.
1. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 2. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.
- D. Install pipe columns on concrete footings with grouted baseplates.
1. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.
 2. Do not grout baseplates of columns supporting steel girders until girders are installed and leveled.

3.3 ADJUSTING AND CLEANING

- A. Galvanized Surfaces:
1. Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 099000 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and field painting of:
 - a. Exterior steel items and surfaces in Paint Schedule.

B. Paint all exposed unfinished exterior surfaces scheduled, except where indicated that surface or material is not to be painted or is to remain natural.

1. If schedules do not indicate color or finish, Architect will select from full range of colors and finishes available.

C. Related Sections:

1. Section 055000, Metal Fabrications.

1.2 SUBMITTALS

A. Product Data: For each paint system specified.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by manufacturers that products supplied comply with all regulations controlling use of volatile organic compounds (VOCs).

B. Samples:

1. Provide stepped Samples of each color, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other contact information.

1.3 QUALITY ASSURANCE

- A. Preparation, Application and Workmanship Standards: In accordance with manufacturer's recommendations and applicable provisions of the following:
 - 1. Painting and Decorating Contractors of America (PDCA) "Painting Specification Manual" and "Standards."
 - a. PDCA P1-92, "Touch-Up Painting and Damage Repair – Financial Responsibility." A properly painted surface is defined in this Standard.
 - b. PDCA P2-92, "Third Party Inspection Qualifications and Responsibilities."
 - c. PDCA P3-93, "Designation of Paint Colors."
 - d. PDCA P4-94, "Responsibilities for Inspection and Acceptance of Surfaces Prior to Painting and Decorating."
 - e. PDCA P5-94, "Benchmark Sample Procedures for Paint and Other Decorative Coating Systems."
- B. Applicator Qualifications: Engage experienced applicator who has completed painting system applications similar in materials and extent to this Project, with record of successful in-service performance.
- C. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from same manufacturer as finish coats.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and:
 - 1. Product name or title of material.
 - 2. Product description.
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in well-ventilated area at minimum ambient temperature of 45° F. Maintain containers used in storage in clean condition, free of foreign materials and residue.
 - 1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.5 PROJECT CONDITIONS

- A. Apply water-based paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90° F.
- B. Do not apply paint in rain, fog, or mist; or when relative humidity exceeds 85 percent, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.6 EXTRA MATERIALS

- A. Furnish extra paint materials from same production run as materials applied in quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish Owner with an additional 5 percent, but not less than one gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with Specifications, these manufacturers may submit paint products.

1. Dunn-Edwards Paints (D-E)
2. Frazee Paints (FR)
3. ICI Paints (ICI)
4. Pittsburgh Paints (PPG)
5. Sherwin-Williams (S-W)

- B. Subject to compliance with Specifications, these manufacturers may submit high performance coatings:

1. Carboline Company (Carboline)
2. DuPont High Performance Coatings (DuPont)
3. Frazee Ameron High Performance Coatings (FR)
4. Sherwin-Williams Industrial and Marine Coatings (S-W)
5. Tnemec (Tnemec)

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish coat materials compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best quality paint material of various coating types specified. Paint material containers not displaying manufacturer's product identification are not acceptable.
- C. Colors: Match colors indicated by reference to manufacturer's color designations.

2.3 EXTERIOR PAINT SCHEDULE

- A. Paint Type A:

1. Provide high performance paint system over exterior ferrous metal surfaces:

- a. Primer: Epoxy primer/sealer applied at spreading rate recommended by manufacturer.
 - 1) Carboline: 890 2-Component Epoxy.
 - 2) D-E Interseal 670 HS.
 - 3) DuPont: 25P High Solids Epoxy Mastic.
 - 4) FR Amerlock 2.
 - 5) ICI/Devoe 235 Bar Rust 2-Component Epoxy.
 - 6) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.
 - 7) S-W Macropoxy B58-600 Series.

- b. Second Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve dry film thickness of 3.0 to 8.0 mils.
 - 1) Carboline: 890 2-Component Epoxy.
 - 2) D-E Interseal 670 HS
 - 3) DuPont: 25P High Solids Epoxy Mastic.
 - 4) FR Amerlock 2.
 - 5) ICI Devoe 235 Bar Rust 2-Component Epoxy.
 - 6) S-W Macropoxy B58-600 Series
 - 7) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.

- c. Third Coat: Semigloss, aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve dry film thickness of 2.0 to 4.0 mils.
 - 1) Carboline: 133-HB 2-Component Aliphatic Polyurethane.
 - 2) D-E Interthane 870
 - 3) DuPont: Imron 326 (13P) Semi-Gloss Polyurethane Enamel.
 - 4) FR Amershield.
 - 5) ICI/Devoe 379 Devthane Aliphatic Urethane.
 - 6) S-W Acralon 218 B65-650 Series
 - 7) Tnemec: Series 1075 Endurashield Aliphatic Acrylic Polyurethane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. With applicator present, examine substrates, areas, and conditions under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting is applicator's acceptance of surfaces and conditions within a particular area.

- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify Architect of any problems using materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items using workers skilled in trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Prepare concrete surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer, and only where approved by Architect.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated. Remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with Steel Structures Painting Council (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as shop coat.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in clean condition, free of foreign materials and residue.
 2. Stir material before application to produce mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match color of finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in Paint Schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats compatible with primers used.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as possible after preparation and before subsequent surface deterioration.
 - 1. Number of coats and film thickness required do not vary, regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 - 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 - 3. If undercoats or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
 - 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical items is limited to items exposed in equipment rooms and in occupied spaces.
- F. Prime Coats: Before applying finish coats, apply prime coat of material, as recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure finish coat with no burn through or other defects due to insufficient sealing.

- G. Opaque Finishes: Completely cover surfaces as necessary to provide smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections are not acceptable.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with Specifications.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves right to invoke following test procedure at any time and as often as Owner deems necessary during period of paint application:
 - 1. Contractor will engage services of an independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform appropriate tests for following characteristics as required by Owner:
 - a. Quantitative material analysis.
 - b. Abrasion resistance.
 - c. Apparent reflectivity.
 - d. Flexibility.
 - e. Washability.
 - f. Absorption.
 - g. Accelerated weathering.
 - h. Dry opacity.
 - i. Accelerated yellowness.
 - j. Recoating.
 - k. Skinning.
 - l. Color retention.
 - m. Alkali and mildew resistance.
 - 3. Owner may direct Contractor to stop painting if test results show material being used does not comply with Specifications. Remove noncomplying paint from site and repaint surfaces previously coated with rejected paint. If necessary, remove rejected paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.
- B. Check mil thickness of all applications by the following methods:
 - 1. Ferrous metal: Elcometer Film Gauge.
 - 2. Other surfaces: Tooke Dry Mil Inspection Gauge.

3.5 CLEANING

- A. Cleanup: At end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PROJECT CLOSE OUT

- A. Submit manufacturer's or distributor's numbered and dated invoices showing type and quantity of products used on Project, and name and telephone number of manufacturer's representative.
- B. Provide Owner with complete information for future matching of all paint products and colors used on the Project.

END OF SECTION 099000

SECTION 260010 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section of the specifications outlines the provisions of the contract work to be performed under this Division and is valid only when considered in total with other Contract Documents. This section applies to and forms a part of each section of the specifications in Divisions 26 and 28 and all work performed under the electrical and communications contracts. Cross references are for convenience of reader and their inclusion in or omission from any section in no way limits its scope or intent of any Contract Document.
- B. In addition, work in this Division is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections under General Requirements.
- C. These specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions. Where the word "provide" or "provision" is used, it shall be definitely interpreted as "furnishing and installing complete in operating condition." Where the words "as indicated" or "as shown" are used, they shall mean as shown on contract drawings. Where items are specified in the singular, this Division shall provide the quantity as shown on the drawings plus any spares or extras mentioned on drawings or in specifications. All specified and supplied equipment shall be new.

1.2 CODES, PERMITS AND FEES

- A. Comply with all applicable laws, ordinances, rules, regulations, codes or rulings of governmental units having jurisdiction, as well as standards of the National Fire Protection Association and serving utility requirements.
- B. Obtain and pay for permits, fees, inspections, meters, utility connections and extensions and the like associated with work in each section of this Division.
- C. Installation procedure, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

1.3 EXAMINATION OF PREMISES

- A. Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

1.4 STANDARDS

- A. The following standard publications of the latest editions and supplements thereto shall form a part of these specifications. All electrical work must, at a minimum, be in accordance with the applicable sections of these standards.

- National Electrical Code (NEC)
- National Fire Protection Association Standards (NFPA).
- Underwriters' Laboratories, Inc. (UL).
- Certified Ballast Manufacturers Association (CBM).
- National Electrical Manufacturers Association (NEMA).
- Radio, Electronics and TV Manufacturers Association.
- Institute of Electrical and Electronic Engineers (IEEE).
- American Society for Testing and Materials (ASTM).
- National Board of Fire Underwriters (NBFU).
- National Board of Standards (NBS).

American National Standards Institute (ANSI).
Insulated Power Cable Engineers Association (IPCEA).
Electrical Testing Laboratories (ETL).
Local Building Codes.

1.5 DEFINITIONS

- A. Concealed: Hidden from sight, as in trenches, chases, hollow construction, above furred spaces, suspended ceilings (acoustical or plastic type), or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- B. Exposed: Not concealed.
- C. Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the "Finish Schedule" with exposed and unpainted construction for walls, floor or ceilings, or specifically mentioned as "unfinished."
- D. Finished Spaces: Any space ordinarily visible to the visiting public, including exterior areas.
- E. "Wiring" includes, in addition to conductors, all raceways, conduit, fittings, boxes, switches, hangers and other accessories related to such wiring.
- F. "Regulating authorities" means all governmental, utility, and fire protection authorities having jurisdiction.
- G. "Provide" means to supply, erect, install, and connect up complete, the particular work referred to, in readiness for regular operation.
- H. "Furnish" means to supply and deliver to the job.
- I. "Install" means to set in place, erect, and connect up complete, the particular work referred to, in readiness for regular operation.
- J. "Approved equal" means equipment or materials which, in the opinion of the Architect, is equal in quality, durability, appearance, strength, design and performance to equipment or material specified and will function adequately in accordance with the general design.

1.6 WORK AND MATERIALS

- A. All electrical materials and equipment shall be new and of the type and quality specified, listed by UL and bear their label where standards have been established, in compliance with the applicable standards of NEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. Replace or repair any nonconforming, damaged or defective items at no extra cost to the Owner.
- B. Materials and equipment shall be standard products of a reputable manufacturer regularly engaged in manufacture of the specified item. Where more than one unit is required of any item, furnish by the same manufacturer, except where specified otherwise. Install material and equipment in accordance with manufacturer's recommendations. Should variance between plans and Specifications occur with these, contact the Architect immediately so that variations in installation can be known by all parties concerned.
- C. Deliver materials or equipment to the Project in the manufacturer's original, unopened, labeled containers, and adequately protect against moisture, tampering or damage from improper handling or storage. Do not deliver materials to the job before they are ready for installation unless adequate security is provided.
- D. Perform all labor in a thorough and workmanlike manner, to the satisfaction of the Architect. Contractor must staff the project with sufficient skilled workmen, including a fully qualified

superintendent, to complete the work in the time allotted. Superintendent must be qualified to supervise all of the work of this Division.

- E. Materials provided under the contract for which the UL label is not normally available shall be mounted in separate enclosures and wired to the labeled units in an acceptable manner.
- F. No electrical equipment, lighting fixtures, junction boxes, etc. shall contain or use foam tape for gaskets or other purposes. Gasket materials shall consist of closed cell neoprene or other approved material.

1.7 SHOP DRAWINGS

- A. Submit all shop drawings and data in accordance with the Special Conditions and at one time for all equipment provided under this Division. The complete electrical shop drawings shall all be bound in one hard-cover, 3-ring binder indexed to this Division.
- B. Shop drawing submittals processed are not change orders. The purpose of shop drawing submittals by the contractor is to demonstrate that the contractor understands the design concept; he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. If deviation, discrepancies or conflicts between shop drawings and specifications are discovered, either prior to or after shop drawing submittals are processed, the design drawings and specifications shall control and shall be followed.
- C. Manufacturers' data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross-sections and maintenance instruction. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.
- D. Index all submittals and reference to these specifications.

1.8 EQUIPMENT PURCHASES

- A. Arrange for purchase and delivery of all materials and equipment within 20 days after approval of submittal. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are not on the project in time to expedite completion, the Owner may purchase said equipment and materials and deduct the cost from the Contract Sum.
- B. Provide all materials of similar class or service by one manufacturer.

1.9 COORDINATION OF TRADES

- A. Schedule and coordinate work with that of other divisions and sections to execute the Contract expeditiously and avoid unnecessary delays.
- B. Examine all specifications and drawings to become familiar with all conditions affecting work, and consult and cooperate with other divisions and sections for determining space requirements and adequate clearances with respect to other equipment in the building. Architect reserves the right to determine space priority in the event of interference between piping, conduit and equipment of various trades.
- C. Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or with Architect, as the case may be, for complete and accurate requirements to result in a neat, workmanlike installation.
- D. If work is installed without coordinating with other trades, and such installation interferes with their installation, correct without charge any work requiring alteration and any damage to adjacent work caused by the alteration.

E. Provide fabrication drawings of critical areas if so directed by Architect.

1.10 PATENTS

A. Refer to the General Conditions for Contractor's responsibilities regarding patents.

PART 2 - PRODUCTS

2.1 WORK AND MATERIALS

A. All electrical materials and equipment shall be new and of the type and quality specified, listed by UL and bear their label where standards have been established, in compliance with the applicable standards of NEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. Replace or repair any nonconforming, damaged or defective items at no extra cost to the Owner.

B. Materials shall be suitable for intended use and location. Unless otherwise shown use enclosure types NEMA-1 for interior areas and NEMA-3R for exterior areas.

C. Perform all labor in a thorough and workmanlike manner, to the satisfaction of the Architect. Contractor must staff the project with sufficient skilled workmen, including a fully qualified superintendent, to complete the work in the time allotted. Superintendent must be qualified to supervise all of the work of this Division.

D. Materials provided under the contract for which the UL label is not normally available shall be mounted in separate enclosures and wired to the labeled units in an acceptable manner.

2.2 APPROVAL OF MATERIALS AND EQUIPMENT

A. Refer to Supplementary General Conditions for description of alternate material and equipment.

PART 3 - EXECUTION

3.1 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., on architectural drawings, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, etc., and install apparatus and equipment in available locations. Install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

C. Verify location and mounting height of all receptacles, wall mounted fixtures, switches, and other equipment before roughing in. See drawings for pertinent information. Refer questionable cases to Architect.

3.2 RECORD DRAWINGS

A. Maintain at site a set of record drawings in accordance with Division 01, which clearly indicate (by shading, coloring, or some other acceptable method) the day-by-day extent of work installed.

3.3 CLOSING-IN OF UNINSPECTED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and

test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.4 EXISTING INSTALLATION AND CONFLICTS

- A. Protect existing active electric services, when encountered, against damage from construction work. Do not prevent or disturb operation of active services which are to remain. If work makes temporary shutdowns of services unavoidable, consult with Owner as to dates, procedures, and estimated duration of shutdown period at least 10 working days in advance of when date work is to be performed.
- B. Arrange work for continuous performance to assure that existing operating services will be shut down only during the time required to make necessary connections. If a system cannot shut down, provide temporary by passes or jumpers until connections are complete.
- C. If existing active utility services are encountered which require relocation, make request to proper authorities for determination of procedures. Properly terminate existing services to be abandoned in conformance with requirements of authorities.
- D. All removed equipment shall remain property of Owner and be stored on site or as directed.
- E. Where connections or disruptions are made to existing systems, reactivate and restore systems to operating conditions at time of disruption.

3.5 FLASHING

- A. Flash and counterflash all conduits penetrating roofing membrane.

3.6 CONSTRUCTION FACILITIES

- A. General: Under this section of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment, and such facilities shall be kept clear of materials or equipment as directed by Architect.
- B. Furnish and maintain from the beginning to completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by city and state laws and OSHA to avoid injury or damage to any persons and property.
- C. Provide scaffolding, rigging, hoisting, and services necessary for erection and delivery of equipment and materials provided under this Division. Remove same from premises when no longer required.
- D. Temporary toilet facilities are specified and furnished under another section.
- E. Temporary power and lighting for construction purposes shall be under this Division. Refer to Division 1 for complete description of work. Work shall include but not be limited to temporary construction power as outlined below. Establish temporary electrical service and maintain through project completion. As necessitated by the progress of construction, provide and maintain outlets at convenient points and in sufficient numbers so that no extension cord over 50 feet in length is required to reach any work point. Provide and maintain general lighting in corridors, stairs, basement and other areas not receiving sufficient daylight required for safety. Remove temporary work as rapidly as required for or allowed by installation of permanent work.

3.7 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS

- A. Provide conduit, wire, manual motor protection switches, magnetic motor protection switches, remote push-button switches, etc., as required and make power connections to motors and equipment furnished under other divisions of the Specifications as noted on the drawings. Provide control wiring (except as specified under Automatic Temperature Control) as outlined above for

"power connections".

- B. All control devices, and starters not in motor control centers, for equipment furnished under the Air Conditioning section (except as specified under Automatic Temperature Control paragraph), Plumbing section, Fire Sprinkler or Lawn Sprinkler section are to be furnished under that particular section and installed under this section.
- C. Wiring diagrams complete with all connection details shall be furnished under each respective section.

3.8 EQUIPMENT ROUGH-IN

- A. Rough in all equipment, fixtures, etc., as designated on the drawings and as specified herein. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from Architectural and equipment shop drawings as applicable. The Contractor shall confirm all rough-in information with the Architect before progressing with any work for rough-in connections.
- B. Be responsible for providing all outlets and services of proper size at the required locations.
- C. Minor changes in the contract drawings shall be anticipated and provided for under this Division to comply with rough-in drawings.

3.9 OWNER FURNISHED AND OTHER EQUIPMENT

- A. Rough in and make final connections to all Owner furnished equipment shown on the drawings and specified and all equipment furnished under other sections of the specifications.

3.10 EQUIPMENT FINAL CONNECTIONS

- A. Provide all final connections for the following:
 - 1. All equipment furnished under this Division.
 - 2. Equipment requiring line voltage electric furnished under other sections of the specifications (except as otherwise designated).
 - 3. Owner furnished equipment as shown on the drawings.

3.11 CLEANUP

- A. In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.
- B. Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- C. During the progress of the work, keep the premises clean and free of debris. PROJECT CLOSEOUT
- D. Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division, as described below.
- E. In addition, furnish caps for all receptacles as described in this Division.

3.12 EQUIPMENT LISTS AND MAINTENANCE MANUALS

- A. Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manual per Division 1 requirements. At a minimum the equipment list shall include the following

items for every piece of material and equipment supplied under this section of the specifications.

1. Name, model and manufacturer.
2. Complete parts drawings and list.
3. Local supply for parts and replacement and telephone number.
4. All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.

B. Maintenance manuals shall be furnished for each applicable section of the specifications per Division 1 requirements. At a minimum the maintenance manual shall include all available manufacturers' operation and maintenance instructions, together with as-built drawings and lists hereinbefore specified and all other diagrams and instructions necessary to properly operate and maintain the equipment. The maintenance manuals shall also include the name, address and phone number of the General Contractor and all subcontractors involved in any of the work specified herein.

3.13 TESTING

A. Upon completion of the electrical work, the entire installation shall be tested and demonstrated to be operating satisfactorily.

B. Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from grounds, short circuits, and any or all defects.

C. Motors shall be operating in proper rotation and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed. Check all electrical equipment for proper operation.

D. Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.

E. All equipment or wiring provided, which tests prove to be defective or operating improperly, shall be corrected or replaced promptly, at no additional cost to the Owner.

F. The insulation system of all feeders (100A or larger), switchboards, motor control centers, motor control starters, panelboards, bus ducts and motors shall be checked and verified by performing a megger test. The megger test voltages and resulting ohm values shall be as specified by National Electrical Testing Association standards. The contractor shall keep a record of all megger testing to indicate the date, the equipment tested, the testing values and test results. These records shall be made available as requested and shall be included with the project record documents.

G. The insulation system of all electrical distribution equipment rated 1000A and greater shall be checked and verified by performing a high potential (Hi-Pot) test. The Hi-Pot test voltages and resulting ohm values shall be as specified by National Electrical Testing Association standards. The contractor shall keep a record of all testing to indicate the date, the equipment tested, the testing values and test results. These records shall be made available as requested and shall be included with the project record documents.

3.14 FINAL OBSERVATION

A. Comply with the requirements of Division 1 - General Requirements.

B. Prior to notifying the Architect/Engineer the project is ready for the final observation, the contractor shall verify the following:

1. All systems are complete and operational.
2. All controls are complete and operational, mechanical interfaces have been checked and are

functioning properly.

3. All light fixtures have been cleaned with all protective coverings removed.
 4. All equipment nameplates have been installed.
 5. All panel directories are typed and installed in corresponding panels.
- C. Once notified the Architect/Engineer will visit the jobsite and will prepare a final "punch list" of all items to be finished or corrected prior to project acceptance by the owner. This division will be responsible to finish or correct all items on this list prior to subsequent verification visit by the Architect/Engineer. In the event additional verification visit(s) are required, the Architect/Engineer shall be compensated at his/her normal rates for subsequent by the contractor responsible for this Division work. Payment for subsequent verification visit(s) is due and payable prior to issuance of final acceptance observation report for this Division.
- 3.15 GUARANTEE
- A. Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defects of material and workmanship for one year from date of final acceptance, as outlined in the General Conditions. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of equipment under all conditions of load, installing any additional items of control and/or protective devices as required.
- B. All new equipment shall be tested through thermal imaging 30 days prior to expiration of this guarantee.

END OF SECTION

SECTION 260020 - SCOPE OF WORK

PART 1 - GENERAL

- 1.1 The work under this Division includes furnishing all labor, material and equipment necessary for the installation and placing into operation of the electrical systems specified herein and as indicated on the drawings.
- 1.2 The work shall also include the completion of such minor details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the drawings or required by these specifications.

PART 2 - SCOPE

- 2.1 The work includes, but is not necessarily limited to, provision of the following:
 - A. Complete temporary power and lighting systems per Division 1 requirements.
 - B. Complete power and lighting systems, transformers, branch circuit panelboards, switches, feeders, branch circuits, lighting fixtures, lamps, controls and accessories.
 - C. Motor and power wiring for all motors and/or equipment furnished under the contract. Except as otherwise specified to be furnished by or under other Divisions of these specifications, all wiring devices, starter wiring, conduit, feeders, control wiring, accessories and final connections to all equipment shall be furnished under this section.
 - D. Install controls for all equipment except as specified under automatic temperature control system.
 - E. Utility company coordination, Power, Telephone, and Cable TV.
 1. Contact the serving Power Company regarding exact locations of primary service equipment, trenching, transformers and meters, etc.
 2. Contact telephone company regarding exact location of primary telephone service equipment, trenching, telephone terminal cabinets (T.T.C.) and telephone mounting boards (T.M.B.), etc.
 3. Contact cable TV company (CATV) regarding exact location of primary CATV service equipment, trenching, etc.
 - F. All work required by the utility companies, Power, Telephone, and CATV.
 1. All necessary trenching, conduit, backfill and concrete pads for transformers and service equipment as required by and to the specifications of the Power Company.
 2. All necessary telephone trenching, backfill, telephone mounting boards (T.M.B.), telephone terminal cabinets (T.T.C.), conduit, grounding, etc. as required by and to the specifications of the telephone company.
 3. All necessary CATV trenching, backfill, conduit, grounding, etc. as required by and to the specifications of the CATV company.
 - G. Line voltage power connections, empty conduits, and outlet boxes for Security system, and other special systems as indicated on the drawings.

- H. All equipment and materials specified in this Division.
- I. Penetration fire stop materials and installation as indicated on the drawings.

PART 3 - AS-BUILT DRAWINGS

- 3.1 The Electrical Division shall maintain as-built drawings as specified in Division 1 requirements.
- 3.2 Drawings shall show locations of all concealed and exposed conduit runs, giving the number and size of conduit and wire. Underground ducts shall be shown with cross-section elevations. Any pipe, conduit or lines of other trades shall be included.
- 3.3 Reproducible as-built drawings shall be delivered to the Architect.
- 3.4 See Division 1 for additional requirements.

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceways and cables.
 - 2. Sleeve seals.
 - 3. Grout.
 - 4. Common electrical installation requirements.

1.2 SUBMITTALS

- A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.

- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.3 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types XHHW, and SO.
- C. Multiconductor Cable: Comply with NEMA WC 70 for nonmetallic-sheathed cable, Type NM, and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 2 AWG; copper or aluminum for feeders No. 2 AWG and larger. Stranded for all sizes.
- B. Branch Circuits: Copper. Stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawspaces: Type XHHW, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawspaces: Type XHHW-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Nonmetallic-sheathed cable, Type NM where permitted by City of Tempe amendments.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type XHHW, in raceway.
- J. Class 2 Control Circuits: Type XHHW, in raceway, Power-limited cable, concealed in building finishes and Power-limited tray cable, in cable tray.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- D. Cut sleeves to length for mounting flush with both wall surfaces.
- E. Extend sleeves installed in floors 2 inches above finished floor level.
- F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- J. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

- K. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test all feeders and branch circuits rated at 100A and greater.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 1 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Stranded Conductors: ASTM B 8.
 - 2. Tinned Conductors: ASTM B 33.
 - 3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: (2) Copper-clad 5/8 by 96 inches in diameter 6 feet apart.

- B. Grounding conductor: 30 feet of bare copper conductor encased in building foundation

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4 AWG minimum. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Metal-clad cable runs.
 - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode

- system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.
- C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or

greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Comply with requirements in Division 09 Painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks and manholes, and underground handholes, boxes, and utility construction.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. EMT: ANSI C80.3.
- C. FMC: Zinc-coated steel.
- D. LFMC: Flexible steel conduit with PVC jacket.
- E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Fittings for EMT: Steel or die-cast, set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.

- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
 - E. Fittings for LFNC: UL 514B.
- 2.3 METAL WIREWAYS
- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
 - B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated.
 - C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - D. Wireway Covers: Hinged type.
 - E. Finish: Manufacturer's standard enamel finish.
- 2.4 SURFACE RACEWAYS
- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- 2.5 BOXES, ENCLOSURES, AND CABINETS
- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
 - B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
 - C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
 - D. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
 - E. Nonmetallic Floor Boxes: Nonadjustable, round.
 - F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 - G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.6 PUTTY PADS

- A. For acoustic treatment and for fire rating at the demising walls in units, between unit to unit and between unit to corridor (all living unit walls except exterior), provide fire rated Putty Pads per IBC 712.3.2 2.3 to wrap all electrical outlets, phone/data/and tv outlets, switch boxes, junction boxes and fire alarm back boxes (on the hollow wall space side) to seal all the gaps in the box and between the box and the drywall. Type SpecSeal SSP4S (7.25" x 7.25" x 3/16") and SSP9S (9.00"x 9.00" x 3/16"), or equal. Coordinate with required box sizes with respective pad sizes prior to ordering boxes.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

- B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: Rigid steel conduit.
2. Exposed, Not Subject to Severe Physical Damage: Rigid steel conduit.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit or EMT depending on location and potential for damage as discussed above.
7. Raceways for Optical Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.

- C. Minimum Raceway Size: 3/4-inch trade size EMT and 3/4-inch PVC.

- D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from Type EPC-40-PVC to rigid steel conduit or EMT after rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install as follows unless noted otherwise on the drawings:
 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 3. Install with a maximum of four 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

- M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- N. Set metal floor boxes level and flush with finished floor surface.
- O. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."
- B. For acoustic treatment and for fire rating at the demising walls in units, between unit to unit and between unit to corridor (all living unit walls except exterior), apply fire rated Putty Pads to wrap all electrical outlets, phone/data/and tv outlets, switch boxes, junction boxes and fire alarm back boxes (on the hollow wall space side) to seal all the gaps in the box and between the box and the drywall.

END OF SECTION

SECTION 260543 - UNDERGROUND CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Direct-buried conduit.
 - 2. Handholes and pull boxes.
 - 3. Manholes.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Comply with IEEE C2.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 HANDHOLES AND PULL BOXES

- A. Description: Comply with SCTE 77.
 - 1. Color: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering,
 - a. "ELECTRIC", "SPECIAL SYSTEMS" OR "TELEPHONE"
 - b. Tier level number, indicating that the unit complies with the structural load test for that tier according to SCTE 77.
 - 6. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

- B. Fiberglass Handholes and Pull Boxes with Polymer Concrete Frame and Cover: Complying with SCTE 77 Tier 15 loading. Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
 - 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. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

PART 3 - EXECUTION

3.1 CORROSION PROTECTION

- A. Aluminum shall not be installed in contact with earth or concrete.

3.2 EARTHWORK

- A. Perform all necessary excavation, shoring and backfilling required for the proper laying of all pipes and conduits inside the building and premises, and outside as may be necessary. Remove all excess excavated materials from the site, or as otherwise directed by Architect.
- B. Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the pipes, doing the remainder by hand. Do not cut any trench near or under footings without first consulting Architect. All trenching shall comply with OSHA Standards and Regulations.
- C. Backfilling shall be done in one foot layers, with each layer tamped before another layer is added. No stones or coarse lumps shall be laid directly on conduits. Provide red warning tape in all electrical trenches at 12" below finished grade.
- D. Trenches shall be filled with the excavated material. Sod, if any, shall be removed in cut sections and replaced in the same manner.
- E. Provide pumps and drainage of all open trenches when installing electrical duct and wiring.

3.3 INSTALLATION OF HANDHOLES AND PULL BOXES

- A. Install handholes and pull boxes level and plumb and with orientation and depth coordinated with conduit sweeps and elbows into box. Use pull box extension if required to match depths of conduit and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level 6-inch- thick bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set so cover surface will be flush with finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

Retain arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

3.4 INSTALLATION OF CONDUITS

- A. All raceways installed underground shall be placed at the minimum depth indicated in NEC Table 300-5 for each specific condition.
- B. Where raceways stacked or banked within the same trench, provide non-metallic spacers placed at maximum of 10ft on center.
- C. No more than four 90 degree bends (total of 360 degrees) will be allowed in one raceway run. Where more bends are necessary, a pull box shall be installed. All bends in 1in and smaller shall be made with a conduit bender and all larger sizes shall have machine bends.
- D. Conduits except where PVC conduit is permitted. All metal underground conduit shall be wrapped with a minimum of one (1) one-half-lapped layer of 10 mil corrosion protection tape (3M Temflex 1100). The corrosion protection tape shall be applied to underground conduits to a point at least 12 inches above grade.
- E. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches on center. Align planks along the width and along the centerline of conduit.

3.5 GROUNDING

- A. Ground underground according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.7 CLEANING

- A. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.2 FLOOR MARKING TAPE

- A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- F. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape and color-coding, appropriately sized weidmuller terminal blocks to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 1/0 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.

- d. Color for grounding conductors:
 - 1) Green
 - e. Colors for neutral (grounded conductors):
 - 1) White, or
 - 2) Gray
 - f. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
 - C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
 - D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
 - E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
 - F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
 - G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Outdoor motion sensors.
 - 5. Lighting contactors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.
- C. Lutron Graphic-eye for architectural dimming system equipment in dining areas as called out on plans.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 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.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Area Lighting Research, Inc.; Tyco Electronics.
 - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 3. Intermatic, Inc.
 - 4. Leviton Mfg. Company Inc.
 - 5. Lightolier Controls; a Genlyte Company.
 - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 7. Paragon Electric Co.; Invensys Climate Controls.
 - 8. Square D; Schneider Electric.
 - 9. TORK.
 - 10. Touch-Plate, Inc.
 - 11. Watt Stopper (The).
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: As noted on the drawings.
2. Contact Rating: 20-A ballast load, 120/277/480V ac.
3. Program: 2 on-off set points (or as noted on the drawings) on a 24-hour schedule, allowing different set points for each day of the week.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
5. Astronomic Time: All channels.
6. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 3. Intermatic, Inc.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Novitas, Inc.
 6. Paragon Electric Co.; Invensys Climate Controls.
 7. Square D; Schneider Electric.
 8. TORK.
 9. Touch-Plate, Inc.
 10. Watt Stopper (The).
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Novitas, Inc.
 5. RAB Lighting, Inc.
 6. Sensor Switch, Inc.
 7. TORK.
 8. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

2.4 OUTDOOR MOTION SENSORS (PIR)

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bryant Electric; a Hubbell Company.
2. Hubbell Lighting.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Paragon Electric Co.; Invensys Climate Controls.
5. RAB Lighting, Inc.
6. TORK.
7. Watt Stopper (The).

B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as raintight according to UL 773A.

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

3. Bypass Switch: Override the on function in case of sensor failure.
 4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.
- C. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
- D. Detection Coverage: Up to 35 feet, with a field of view of 180 degrees.
- E. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Allen-Bradley/Rockwell Automation.
 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 4. GE Industrial Systems; Total Lighting Control.
 5. Grasslin Controls Corporation; a GE Industrial Systems Company.
 6. Hubbell Lighting.
 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 8. MicroLite Lighting Control Systems.
 9. Square D; Schneider Electric.
 10. TORK.
 11. Touch-Plate, Inc.
 12. Watt Stopper (The).
- B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
- C. BAS Interface: Provide hardware interface to enable the BAS to control lighting contactors.
1. Control: On-off operation.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to four visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, switchboards and enclosed controllers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Feeders: Class L, time delay, Class RK5, time delay and Class J, time delay].
- B. Motor Branch Circuits: Class RK5, time delay.
- C. Other Branch Circuits: Class RK5, time delay and Class J, time delay.
- D. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 and 600 -V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 and 600 -V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Lugs: Suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4
 4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Install fuses in fusible devices.
- C. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply and feeder.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
- B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.
- C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
 - 1. Basic wind speed for calculating wind load for poles 25 feet high or less is 100 mph.
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 25 years.
 - c. Velocity Conversion Factors: 1.0.

1.3 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: See fixture schedule.
- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: Verify with Architect.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:
 - a. "USES ONLY" and include specific lamp type.
 - b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - f. CCT and CRI for all luminaires.

2.3 FLUORESCENT BALLASTS AND LAMPS

A. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 20 percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

2.4 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: 0 deg F.
3. Normal Ambient Operating Temperature: 122 deg F.

B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

2.5 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.6 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

2.7 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.
 - 1. Shape: See Fixture Schedule.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Single-arm type or as noted on Fixture Schedule, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with galvanized-steel bolts.

2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 3. Match pole material and finish.
- D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- F. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
 3. Trees: 15 feet from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers unless otherwise indicated.
 - 4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
 - E. Raise and set poles using web fabric slings (not chain or cable).
- 3.3 BOLLARD LUMINAIRE INSTALLATION
- A. Align units for optimum directional alignment of light distribution.
 - B. Install on concrete base with top at finished grade or surface at bollard location. Cast conduit into base.
- 3.4 CORROSION PREVENTION
- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
 - B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
- 3.5 GROUNDING
- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
 - B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding conductor and conductor protector.

END OF SECTION

SECTION 280200 – CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. UTP cabling.
2. 50/125 and 62.5/125-micrometer, multimode optical fiber cabling.
3. Coaxial cabling.
4. RS-232 cabling.
5. RS-485 cabling.
6. Low-voltage control cabling.
7. Control-circuit conductors.
8. Identification products.

1.2 DEFINITIONS

- A. Basket Cable Tray: Fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: Fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. Ladder Cable Tray: Fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- G. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50V or for remote-control and signaling power-limited circuits.
- H. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- I. RCDD: Registered Communications Distribution Designer.
- J. Solid-Bottom or Nonventilated Cable Tray: Fabricated structure consisting of integral or separate longitudinal side rails, and bottom without ventilation openings.
- K. Trough or Ventilated Cable Tray: Fabricated structure consisting of integral or separate maximum longitudinal rails and bottom having openings sufficient for passage of air, using 75 percent of horizontal area to support cables.
- L. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal outside diameter.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings: Cable tray layout, showing cable tray route to scale, in relation to adjacent structural, electrical, and mechanical elements. Include the following:
 - 1. Vertical and horizontal offsets and transitions.
 - 2. Clearances for access above and to side of cable trays.
 - 3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - 4. Load calculations to show dead and live loads do not exceed manufacturer's rating for tray and support elements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Nationally Recognized Testing Laboratory (See osha.gov).
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cable to determine continuity of strand end to end. Use optical loss test set.
 - 2. Test optical fiber cable on reels. Use optical time domain reflectometer to verify cable length and locate cable defects, splices, and connector. Include loss value of each. Retain test data and include record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during construction.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of Category 5e and Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- B. Cable Trays:
 - 1. Subject to compliance with Specifications, products by these manufacturers may be submitted:
 - a. Cable Management Solutions
 - b. Cablofil
 - c. Cooper B-Line
 - d. GS Metals
 - 2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch thick.
 - a. Basket Cable Trays: 6 inches wide and 2 inches deep. Wire Mesh Spacing: Do not exceed 2 by 4 inches.
 - b. Trough Cable Trays: Nominally 6 inches wide.
 - c. Ladder Cable Trays: Nominally 18 inches wide, with rung spacing of 12 inches.
 - d. Channel Cable Trays: One-piece construction, nominally 4 inches wide. Slot Spacing: Do not exceed 4-1/2 inches on center.
 - e. Solid Bottom Cable Trays: One-piece construction, nominally 12 inches wide, with solid covers.
- C. Conduit and Boxes: Comply with Specifications in Division 26 Section "Raceway and Boxes for Electrical Systems." Do not use flexible metal conduit.
 - 1. Outlet Boxes: No smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

- A. Plywood, fire-retardant treated backboards, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 061050, Miscellaneous Rough Carpentry.

2.3 UTP CABLE

A. Subject to compliance with Specifications, products by these manufacturers may be submitted:

1. Belden CDT
2. Berk-Tek
3. Krone
4. Mohawk
5. Nordex/CDT
6. Superior Essex

B. Material: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e and Category 6.
4. Listed and labeled by NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Subject to compliance with Specifications , products by these manufacturers may be submitted:

1. Hubbell Premise Wiring
2. Krone
3. Leviton Voice & Data
4. Molex Premise Networks
5. Nordex/CDT
6. Panduit

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Terminate cables with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style for Category 5e and 110-style for Category 6 or 66-style for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare blocks. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Subject to compliance with Specifications, products by these manufacturers may be submitted:

1. Berk-Tek
2. Corning Cable Systems
3. General Cable Technologies

4. Mohawk
 5. Nordex/CDT
 6. Optical Connectivity Solutions
 7. Superior Essex
- B. Description: Multimode, 50/125 or 62.5/125-micrometer, nonconductive, tight buffer, optical fiber cable. Refer to Drawings for quantity of fiber strands.
1. Comply with ICEA S-83-596 for mechanical properties.
 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 3. Comply with TIA/EIA-492AAAA-B TIA/EIA-492AAAA-A for detailed specifications.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC OFCG or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
 - e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, complying with UL 1666.
 5. Conductive Cable: Steel armored type.
 6. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Description: Singlemode, 9/125-micrometer, 12 -fiber, nonconductive, tight buffer, optical fiber cable. Suitable for SONET transport at OCX. Refer to Drawings for quantity of fiber strands.
1. Comply with ICEA S-83-596 for mechanical properties.
 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 3. Comply with ITU recommendation G652.C for characteristics of single mode f/o cable.
 4. Comply with TIA/EIA-492CAAB for detailed specifications of dispersion-unshifted single mode optical fiber with low water-peak.
 5. Listed and labeled by NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.
 6. Conductive Cable: Steel armored type.
 7. Maximum Attenuation: 1.0 dB/km at 1310 nm; 1.0 dB/km at 1383+/-3; 0.75dB/km at 1550nm.
 8. Zero Dispersion Wavelength: 1302nm – 1322nm.
- D. Jacket:
1. Jacket Color: Aqua for 50/125-micrometer cable, Orange for 62.5/125-micrometer cable.
 2. Cable cordage jacket, fiber, unit, and group color according to TIA/EIA-598-B.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
4. All cable installed within underground conduit will have wet location marked and approved outer jacket.

2.6 OPTICAL FIBER CABLE HARDWARE

- A. Subject to compliance with Specifications, products by these manufacturers may be submitted:
1. Berk-Tek
 2. Corning Cable Systems
 3. Molex Premise Networks
 4. Nordex/CDT
 5. Optical Connectivity Solutions Division
- B. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
1. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
 2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

- A. Subject to compliance with Specifications, products by these manufacturers may be submitted:
1. Alpha Wire
 2. Belden CDT
 3. Coleman Cable
 4. Superior Essex
 5. West Penn
- B. General Coaxial Cable Requirements: Coaxial cable elements have 75-ohms nominal impedance and are 100 percent factory-sweep tested to meet or exceed requirements of NFPA 70, Articles 725, 800, and 820. All cable installed within underground conduit will have wet location marked and approved outer jacket.
- C. RG-11/U: 75 Ohm Coaxial CCTV Cable.
1. No. 14 AWG, solid, bare copper conductor.
 2. Gas-injected, foam-PE insulation.
 3. Shielded with 95 percent bare copper braid.
 4. Jacketed with sunlight-resistant, black PVC or PE.
 5. Suitable for outdoor installations in ambient temperatures ranging from minus 30 to plus 75 deg C.
- D. RG59/U: NFPA 70, Type CATVR.
1. No. 20 AWG, solid, copper conductor.
 2. Gas-injected, foam-PE insulation.
 3. Shielded with 95 percent bare copper braid.

4. Color-coded PVC jacket.

E. RG-6/U: 75 Ohm Coaxial CCTV Cable

1. No. 18 AWG, solid, copper conductor.
2. Gas-injected, foam-PE insulation.
3. Shielded with 95 percent bare copper braid.
4. Color-coded PVC jacket.
5. Suitable for indoor installations.

F. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655. Types include:

1. CCTV Cable: Type CM.
2. CCTV Plenum Rated: Type CMP.
3. CCTV Riser Rated: Type CMR, complying with UL 1666.

2.8 COAXIAL CABLE HARDWARE

A. Subject to compliance with Specifications, products by these manufacturers may be submitted:

1. Aim Electronics.
2. Leviton Voice & Data.

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 LOW VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Lock Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.12 CONTROL CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway power-limited cable, concealed in building finishes, power-limited tray cable, in cable tray complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.
- D. All cable installed within underground conduit have wet location marked and approved outer jacket.

2.13 IDENTIFICATION PRODUCTS

- A. Subject to compliance with Specifications, products by these manufacturers may be submitted:
 - 1. Brady
 - 2. HellermannTyton
 - 3. Kroy
 - 4. Panduit
- B. Comply with UL 969 for system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.14 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test measures frequency response (attenuation over frequency) of a cable by generating voltage whose frequency is varied through specified frequency range, and records results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing, length of conduit, and number of bends between pull points.

- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduit and wire ways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to corner of backboard where plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 4 inches above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors. Leave no unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 5. Do not splice cables. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radius, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace with new cable.
 - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps.
 - 9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
 - 10. Install low voltage cables in existing cable tray where available.
- C. UTP Cable Installation:
 - 1. Comply with TIA/EIA-568-B.2.
 - 2. Do not untwist UTP cables more than 1/2 inch from point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
 - 1. Comply with TIA/EIA-568-B.3.

2. Terminate cables on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in wireway or pathway minimum 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Do not run cable through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Access Flooring:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in access floor areas.
3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.

G. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with O-rings to keep out moisture. If underground, place in conduit and use "wet location" rated jacket.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.
3. All cable installed within underground conduit will have wet location marked and approved outer jacket.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment:
 - a. Electrical Equipment Rating Less Than 2 kVA: Minimum 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: Minimum 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: Minimum 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment:
 - a. Electrical Equipment Rating Less Than 2 kVA: Minimum 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: Minimum 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: Minimum 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: Minimum 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: Minimum 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: Minimum 48 inches.

6. Separation between Cables and Fluorescent Fixtures: Minimum 5 inches.

3.3 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.4 CONNECTIONS

A. Comply with requirements in Division 28 Sections:

1. "Access Control" for connecting, terminating, and identifying wires and cables.
2. "CCTV" for connecting, terminating, and identifying wires and cables.

3.5 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements of Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - a. Test Instruments: Meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with atester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified

in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

- a. Test Instruments: Meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters qualified by test equipment manufacturer for channel or link test configuration.
- b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, one Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- C. Document data for each measurement. Print data for submittals in summary report formatted using Table 10.1 in BICSI TDMM as guide, or transfer the data from instrument to computer, save as text files, print, and submit.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 280200

SECTION 280300 - COMMON WORK RESULTS FOR ELECTRONIC SECURITY SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electronic security equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electronic security installation requirements.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Product Data: For sleeve seals.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches: Thickness of 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches: Thickness of 0.138 inch.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Subject to compliance with Specifications, products from these manufacturers may be submitted:
 - a. Advance Products & Systems.
 - b. Calpico.
 - c. Metraflex.
 - d. Pipeline Seal and Insulato.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 4 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Firestopping."

- J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 280300

SECTION 281500 – CLOSED CIRCUIT TELEVISION SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Work Includes:

1. CCTV system switching and recording equipment is existing. Work will include the installation of new cameras to be integrated with the existing systems.
2. Although such work or equipment is not specifically indicated, furnish and install all supplementary or miscellaneous items, and devices incidental to or necessary for a sound, secure, operational, and complete system installation.
3. In order to insure standardization, proper interface and compatibility, it is required that all work under this section be furnished and installed by the owner's current security systems maintenance contractor: BCD Low Voltage.

B. System Description:

1. Cameras associated with security system alarms or events will be switched to appropriate system monitor
2. Existing head end is a Pelco 9700 series switcher.

1.2 SUBMITTALS

- A. Product Data: Provide detailed information for all materials, finished dimensions and installation for all devices and test and performance reports. Submit power supply and UPS sizing calculations.
- B. Shop Drawings: Submit complete Shop Drawings and installation drawings for review by Architect before fabrication and delivery.
- C. Submit camera sequence and call up/alarm matrix for Owner's review and acceptance before programming.
- D. Performance Measurements: Record and submit all performance measurements in complete test report.
- E. Camera color samples.

1.3 WARRANTY

- A. Provide manufacturer's standard three-year warranty for equipment.
- B. Provide installation and labor warranty for two years.
- C. Warranties begin on date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Cameras for existing CCTV system manufactured by Pelco (pelco.com). No substitutions.

2.2 MATERIALS

- A. Camera Schedule: Refer to Drawings for camera locations. Refer to Camera Schedule for camera types. Not all camera types listed are necessarily used in this project.

1. Type A: Pan/Tilt/Zoom Dome Camera Exterior:

- a. Environmental housing, mounting arm, and pole mount.
- b. Enclosure designed for exterior use with sunshield, wiper and heater.
- c. The motorized dome have remote programming capability.
- d. Image device: Color High Resolution CCD with line lock module.
- e. Power Requirement: 24VAC, 60Hz
- f. Maximum optical zoom setting of 35x, day/night. Full 12x digital zoom.
- g. The camera will be provided with high level, programmable functions. The auto iris and AGC will be adjustable. The automatic shutter speed will work with an auto exposure feature.
- h. All color cameras must have white balance and sharpness commands, pan blanking, privacy masking up to 6 areas, guard tour preset and password control.
- i. Backlight compensation will be programmable for its relative setting.
- j. Sensitivity: .055lux at 1/60sec.
- k. Sustained temperature of -60°F to +122° F.
- l. Operating humidity range of 0-100% relative, condensing humidity.
- m. Provide with fiber transmitter and power transformer.
- n. Provide Bosch High Speed Positioning System with ????? series camera.

2. Type B: Pan/Tilt/Zoom Dome Camera Exterior:

- a. Environmental housing, mounting arm, and pole mount.
- b. Enclosure designed for exterior use with sunshield, and heater.
- c. The motorized dome have remote programming capability.
- d. Image device: Color High Resolution CCD with line lock module.
- e. Power Requirement: 24VAC, 60Hz
- f. Maximum optical zoom setting of 35x, day/night. Full 12x digital zoom.
- g. The camera will be provided with high level, programmable functions. The auto iris and AGC will be adjustable. The automatic shutter speed will work with an auto exposure feature.
- h. All color cameras must have white balance and sharpness commands, pan blanking, privacy masking up to 6 areas, guard tour preset and password control.
- i. Backlight compensation will be programmable for its relative setting.
- j. Sensitivity: .055lux at 1/60sec.
- k. Sustained temperature of -60°F to +122° F.
- l. Operating humidity range of 0-100% relative, condensing humidity.
- m. Provide with fiber transmitter and power transformer.
- n. Provide Pelco Spectra VI, 35x.

3. Fixed pole mounted exterior:
 - a. 1/3 inch CCD
 - b. Day/Night
 - c. Electronic zoom
 - d. 530 TV Lines B-W, 480 TV lines color
 - e. DF5 Environmental housing with arm, heater, sunshield, blower.
 - f. Mini fiber converter and transformer. Pole mount adapter.
 - g. Pelco CCC1390H Series.

- B. Switching and Control System:
 1. Matrix Switcher is Existing:
 - a. Add input cards to the existing Pelco 9700 series switcher as necessary.

- C. Digital Video Recorder (DVR) is an existing Pelco DX8100.
 1. New camera will be looped through existing switcher and into the existing DVR.

- D. Signal Transmission Components:
 1. Cable installed in conduit in all areas except for equipment connections and transition in security electronic rooms. Surge suppression is required on all devices not attached or inside of building. Surge suppression with clamping voltage of 33VDC, within <1ns.
 - a. CCTV Video Distribution: Refer to Section 280200 Conductors and Cables for Electronic Security. Where required by codes, provide plenum rated outer jacket.
 - b. Cable requirements not to exceed:

0- 750 feet length	RG-59
750 – 1000 feet length.....	RG-6
1000 – 1500 feet length.....	RG-11

 2. CCTV Coaxial Cable Connectors: Type BNC, 75 ohms.
 - a. Connectors: Match camera cable connectors.
 - b. Wall Plates: Match materials and finish of power outlets in the same space.

 3. Fiber Optic Transmission: Provide fiber optic receivers and transmitters as required as indicated on the Drawings, and when video signals are required to be transmitted between separate buildings. Equipment will be fully compatible with the cameras, switchers, and controls specified herein for use on this project. Equipment will be combination video and data converters. Data will be one or two way as required by camera system to provide complete control and offer full functionality of the camera system. Video signals to and from any pole mounted camera will require fiber optic transmission, no exception.

E. Site Camera Poles:

1. Basis of Design: Valmont DS210-700A200. Maximum deflection of ½" in 30 mph wind, or approved equal with manufacturer's certification of wind load and the following requirements:
 - a. Pole: 7.00" base dia. X 4.2" top dia. x 15'-0" long x 0.1196" thick (11 gauge) x 55 ksi.
 - b. Hinged Base Plate: 10.875" square x 0.875" thick x 36 ksi.
 - c. Anchor Bolts: (4 ea.) 1.0" x 36" long x 4" hook x 55 ksi x 10.0" dia. bolt circle.
 - d. Factory finish paint. Coordinate color to site light poles.

PART 3 – EXECUTION:

3.1 INSTALLATION

- A. Provide all necessary cabling and wiring with amplifiers, connectors, etc., as required to maintain optimum signal being viewed on this system. For video runs of over 1,000 feet, provide fiber optic transfer.
- B. CCTV camera symbol orientation indicated on Drawings is schematic, to indicate desired view. After camera installation and during system initiation and set up, field adjustments will be made as required to the field of view for the area to be monitored. Coordinate with the Owner to adjust lens direction and focal length. Document the date and Owner's representative present during this complete system adjustment.
- C. Verify, prior to installation of ceiling-mounted enclosures, that field of view of camera is not obstructed by breaks in ceiling heights, lighting fixtures, fire alarm devices, mechanical fixtures, duct work, or plumbing fixtures. If such conflicts occur, coordinate with Architect before installation.
- D. Provide adequate support for all ceiling mounted enclosures to provide a vandal proof condition after installation. Installed unit incapable of being pulled down with less than 100 pounds of pressure.
- E. Provide interface with intercom and alarm systems for automatic camera call up.
- F. Outdoor Installation: Comply with ANSI C2, "National Electrical Safety Code."
- G. Install surge suppressors where AC power-operated devices are not protected against voltage transients by integral surge suppressors specified in UL 1449. Install surge suppressors at the devices' power-line terminals. Comply with Division 26 Section "Transient Voltage Suppression."
- H. Exterior CCTV Pole provided and installed by Electrical Contractor. Support and anchor pole-mounted cameras, masts, and mountings.
 1. Concrete Foundations: Reinforced concrete complying with Section 033000, Cast in Place Concrete.
 2. Steel Anchorage Components: Galvanized-steel shapes and plates complying Section 051200, Structural Steel.

- I. Wiring Method: Install cables in raceways, except in accessible indoor ceiling spaces and attics, in hollow gypsum board partitions, and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.
- J. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radius. Provide and use lacing bars and distribution spools.
- K. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace with new cable.
- L. Equalizing Video Signals: Where system performance may be degraded in certain operating modes, revise component connections and install video distribution amplifiers and attenuators as required to provide a balanced signal across the system.
- M. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- N. Grounding: Provide independent signal circuit grounding recommended by manufacturer. Provide and install ground isolation transformers for signal circuit.

3.2 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested by Owner within one year of date of Substantial Completion, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance. Provide up to two adjustments at Project site for this purpose, without additional cost.

3.3 OPERATIONS AND MAINTENANCE MANUALS

- A. Provide six (6) copies of operation and maintenance manuals indicating schematics, as-built conditions, parts list and all other information required for proper repair and maintenance of systems.

END OF SECTION 281500

SECTION 281700 - ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes installation of field devices and integration to an existing DSX access control system.
- B. Related Sections:
 - 1. Section 280200, Conductors and Cable for Electronic Security Systems.
 - 2. Section 280300, Common Work Results for Electronic Security Systems.
 - 3. Section 281500, Closed Circuit Television System.
- C. In order to insure standardization, proper interface and compatibility, it is required that all work under this section be furnished and installed by the owner's current security systems maintenance contractor: BCD Low Voltage.

1.2 SYSTEM DESCRIPTION

- A. PC-based Administrative Station, one or more networked PC-based workstations interfaced with field-installed Controllers, connected by a high-speed electronic data transmission network.
 - 1. System Software: Based on 32 bit, Microsoft Windows or Microsoft Windows NT central station, workstation operating system, server operating system, and application software. Software must have the following capabilities:
 - a. Multiuser multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
 - b. Video graphic user interface to show pull-down menus and a menu tree format that complies with interface guidelines of Microsoft Windows operating system. Includes video graphic user interface for AutoCAD drawing import for screen development.
 - c. System license must be for the entire system and include capability for future additions that are within the indicated system size limits specified in this Section.
 - d. System must have open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows operating system.
 - e. The Contractor will provide all software configuration files for all and any software utilized on the project.
 - f. Password-protected operator login and access.
- B. Network connecting the Master Control and workstations must be LAN using Microsoft Windows-based TCP/IP with a capacity of connecting up to 99 workstations.
- C. Network(s) connecting PCs and Controllers must consist of one or more of the following:
 - 1. Local area, IEEE 802.3 Fast Ethernet 100 BASE-T, star topology network based on TCP/IP.
 - 2. Direct-connected, RS-232 cable from the COM port of the Master Control to the first Controller, then RS-485 to interconnect the remainder of the Controllers at that Location.

1.3 PERFORMANCE REQUIREMENTS

- A. Security access system must use a single database for access-control and credential-creation functions.
- B. Distributed Processing: System must be a fully distributed processing system so that information, including time, date, valid codes, access levels, and similar data, is downloaded to Controllers so that each Controller makes access-control decisions for that Location. Do not use intermediate Controllers for access control. If communications to Master Control are lost, all Controllers must automatically buffer event transactions until communications are restored, at which time buffered events must be uploaded to the Master Control.
- C. Number of Locations: Support at least 32,000 separate locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each location.
 - 1. Each Location must have its own database and history in the Master Control. Locations may be combined to share a common database.
- D. Data Capacity:
 - 1. 130 different card-reader formats.
 - 2. 999 comments.
 - 3. 16 graphic file types for importing maps.
- E. Location Capacity:
 - 1. 128 reader-controlled doors.
 - 2. 50,000 total access credentials.
 - 3. 2048 supervised alarm inputs.
 - 4. 2048 programmable outputs.
 - 5. 32,000 custom action messages per location to instruct operator on action required when alarm is received.
- F. System Network Requirements:
 - 1. Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
 - 2. Communication must not require operator initiation or response, and must return to normal after partial or total network interruption such as power loss or transient upset.
 - 3. System must automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.
 - 4. Communications Controller may be used as an interface between the Master Control display systems and the field device network. Communications Controller must provide functions required to attain the specified network communications performance.
- G. Master Control must provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Master Control must control system networks to interconnect all system components, including workstations and field-installed Controllers.
- H. Field equipment must include Controllers, sensors, and controls. Controllers must serve as an interface between the Master Control and sensors and controls. Data exchange between the Master Control and the Controllers must include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the

Master Control must include status data such as intrusion alarms, status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.

- I. System Response to Alarms: Field device network must provide a system end-to-end response time of 1 second(s) or less for every device connected to the system. Alarms must be annunciated at the Master Control within 1 second of the alarm occurring at a Controller or device controlled by a local Controller, and within 100 ms if the alarm occurs at the Master Control. Alarm and status changes must be displayed within 100 ms after receipt of data by the Master Control. All graphics must be displayed, including graphics-generated map displays, on the console monitor within 5 seconds of alarm receipt at the security console. This response time must be maintained during system heavy load.
- J. False Alarm Reduction: The design of Master Control and Controllers must contain features to reduce false alarms. Equipment and software must comply with SIA CP-01.
- K. Error Detection: A cyclic code error detection method must be used between Controllers and the Master Control, which must detect single- and double-bit errors, burst errors of eight bits or less, and at least 99 percent of all other multibit and burst error conditions. Interactive or product error detection codes alone will not be acceptable. A message must be in error if one bit is received incorrectly. System must retransmit messages with detected errors. A two-digit decimal number must be operator assignable to each communication link representing the number of retransmission attempts. When the number of consecutive retransmission attempts equals the assigned quantity, the Master Control must print a communication failure alarm message. System must monitor the frequency of data transmission failure for display and logging.
- L. Data Line Supervision: System must initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.
- M. Door Hardware Interface: Coordinate with Division 8 Sections that specify door hardware required to be monitored or controlled by the security access system. The Controllers in this Section must have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 8 Sections to function with the controls and PC-based software and hardware in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data must comply with SIA BIO-01.
- B. Shop Drawings:
 - 1. Diagrams for cable management system.
 - 2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable.
 - 3. Wiring Diagrams. Show typical wiring schematics including:
 - a. Workstation outlets, jacks, and jack assemblies.
 - b. Patch cords.
 - c. Patch panels.
 - 4. Battery and charger calculations for Master Control, workstations, and Controllers.

C. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. Include the following:

1. Microsoft Windows software documentation.
2. The Contractor will provide all software configuration files for all and any software utilized on the project
3. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software must include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
4. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
5. System installation and setup guides, with data forms to plan and record options and setup decisions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

B. Source Limitations: Obtain Controllers, identifier readers, and all software through one source from a single manufacturer.

C. 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.

D. Comply with NFPA 70, "National Electrical Code."

E. Comply with SIA DC-01 and SIA DC-03 and SIA DC-07.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Workstations, and Controllers:

1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50° and 85° F, and not more than 80 percent relative humidity, noncondensing.
2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
3. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: System must be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85° F and a relative humidity of 20 to 80 percent, noncondensing.
 2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments must be rated for continuous operation in ambient conditions of 36° to 122° F dry bulb and 20 to 90 percent relative humidity, noncondensing. NEMA 250, Type 1 enclosure.
 3. Interior, Uncontrolled Environment: System components installed in non-air-conditioned and non-temperature-controlled interior environments must be rated for continuous operation in ambient conditions of 0° to 122 ° F dry bulb and 20 to 90 percent relative humidity, noncondensing. NEMA 250, Type 12 enclosures.
 4. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Laser Printers: Three toner cassettes and one replacement drum unit.
 2. Credential card blanks, ready for printing. 200 blanks plus an extra 25 percent for future use.
 3. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with Specifications and integration with owners existing system, only products from these manufacturers may be submitted:
1. DSX
 2. Talk-A-Phone

2.2 APPLICATION SOFTWARE

- A. System Software: Based on 32 bit, Microsoft Windows central-station and workstation operating system and application software. Software must have the following features:
1. The Contractor will provide all software configuration files for all and any software utilized on the project.
 2. All control and monitoring as well as login logic shall be programmed within the software native format program for all software applications.
 3. No proprietary DLL or other encrypted software shall be considered.

4. If it is found that system integrator provided any proprietary programming language or encrypted software the system shall be completely redeveloped at the integrator's expense.
 5. The system integrator shall turn over to the all programming passwords, source codes and programming schedules at the end of the project.
- B. Application Software: Interface between the alarm annunciation and entry-control Controllers, to monitor sensors, operate displays, report alarms, generate reports, and help train system operators. Software must have the following functions:
1. Resides at the Master Control Station, workstations, and Controllers as required to perform specified functions.
 2. Operate and manage peripheral devices.
- C. Controller Software:
1. Controllers must operate as an autonomous intelligent processing unit. Controllers must make decisions about access control, alarm monitoring, linking functions, and door locking schedules for its operation, independent of other system components. Controllers must be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, must be maintained in the Controller.
 2. Functions: The following functions must be fully implemented and operational within each Controller:
 - a. Monitoring inputs.
 - b. Controlling outputs.
 - c. Automatically reporting alarms to the Master Control via PLC interface.
 - d. Reporting of sensor and output status to Master Control via PLC interface on request.
 - e. Maintaining real time, automatically updated at least once a day.
 - f. Communicating with the Master Control Station via PLC and VGUI.
 - g. Executing Controller resident programs.
 - h. Diagnosing.
 - i. Downloading and uploading data to and from the Card Access Administration Unit.
 3. Controller Operations at a Location:
 - a. Location: Up to 64 Controllers connected to RS-485 communications loop. Globally operating I/O linking and anti-passback functions between Controllers within the same Location without central-station or workstation intervention. Linking and anti-passback must remain fully functional within the same Location even when the Master Control or workstations are off line.
 - b. In the event of communications failure between the Master Control and a Location, there must be no degradation in operations at the Controllers at that Location. The Controllers at each Location must be connected to a memory buffer with a capacity to store up to 10,000 events; there must be no loss of transactions in system history files until the buffer overflows.
 - c. Buffered events must be handled in a first-in-first-out mode of operation.
 4. Communications Monitoring:
 - a. System must monitor and report status of RS-485 communications loop of each Location.

- b. Communication status window must display which Controllers are currently communicating, a total count of missed polls since midnight, and which Controller last missed a poll.
 - c. Communication status window must show the type of CPU, the type of I/O board, and the amount of RAM memory for each Controller.
 - 5. Operating systems must include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock must be automatically synchronized with the Master Control at least once a day to plus or minus 10 seconds. The time synchronization must be automatic, without operator action and without requiring system shutdown.
- D. PC-to-Controller Communications:
 - 1. Central-station or workstation communications must use the following:
 - a. Direct connection using serial ports of the PC.
 - b. TCP/IP LAN network interface cards.
 - 2. Serial Port Configuration: Each serial port used for communications must be individually configurable for "direct communications," "modem communications incoming and outgoing," or "modem communications incoming only"; or as an ASCII output port.
 - 3. Multipoint Communications Board: Use if more than two serial ports are needed.
 - a. Expandable and modular design. Use a 4-, 8-, or 16-serial port configuration that is expandable to 32 or 64 serial ports.
 - b. Connect the first board to an internal PCI bus adapter card.
- E. Controller-to-Controller Communications:
 - 1. Controller-to-Controller Communications: RS-485, 4-wire, point-to-point, regenerative (repeater) communications network methodology.
 - 2. RS-485 communications signal must be regenerated at each Controller.
- F. Database Downloads:
 - 1. All data transmissions from PCs to a Location, and between Controllers at a Location, must include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download must be automatically retransmitted.
 - 2. Override Groups Containing I/Os:
 - a. Icon must change automatically to show the live summary status of points in that group at the VGUI screen.
 - b. Override group icon must provide a method to manually control or set to time zone points in the group.
 - c. Override group icon must allow the expanding of the group to show icons representing the live status for each point in the group, individual control over each point, and the ability to compress the individual icons back into one summary icon.
 - 3. Schedule Overrides of I/Os and Override Groups:

- a. To accommodate temporary schedule changes that do not fall within the holiday parameters, the operator must have the ability to override schedules individually for each input, output, or override group.
 - b. Each schedule must be composed of a minimum of two dates with separate times for each date.
 - c. The first time and date must be assigned the override state that the point must advance to, when the time and date become current.
 - d. The second time and date must be assigned the state that the point must return to, when the time and date become current.
4. Copy command in database must allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.

G. Alarms:

1. System Setup:

- a. Assign manual and automatic responses to incoming point status change or alarms
- b. Automatically respond to input with a link to other inputs, outputs, operator response plans, unique sound with use of WAV files, and maps or images that graphically represent the point location.
- c. 60-character message field for each alarm.
- d. Operator-response-action messages must allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup must assign messages to access point zone sensor or other alarm originating device.
- e. Secondary messages must be assignable by the operator for printing to provide further information and must be editable by the operator.
- f. Allow 25 secondary messages with a field of 4 lines of 60 characters each.
- g. Store the most recent 1000 alarms for recall by the operator using the report generator.

2. Software Tamper:

- a. Annunciate a tamper alarm at VGUI and Administrative terminal when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system must generate a software tamper alarm.
- b. Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond their authorization level.
- c. Maintain a transcript file of the last 5000 commands entered at the each Master Control administrative terminal to serve as an audit trail. System must not allow write access to system transcript files by any person, regardless of their authorization level.
- d. Allow only acknowledgment of software tamper alarms.

3. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
4. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
5. Alarm Automation Interface: High-level interface to Master Control alarm automation software systems. Allows input alarms to be passed to and handled by automation systems in same manner as burglar alarms, using an RS-232 ASCII interface.

6. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.
- H. Alarm Monitoring: Monitor sensors, Controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm must not be considered acknowledgment of other alarms nor must it inhibit reporting of subsequent alarms.
1. Displayed alarm data must include type of alarm, location of alarm, and secondary alarm messages.
 2. Printed alarm data must include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.
 3. Maps must automatically display the alarm condition for each input assigned to that map, if that option is selected for that input location.
 4. Alarms initiate a status of "pending" and require the following two handling steps by operators:
 - a. First Operator Step: "Acknowledged." This action must silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
 - b. Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm must then clear.
 5. Each workstation must display the total pending alarms and total unresolved alarms.
 6. Each alarm point must be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.

Once an alarm is acknowledged, the operator must be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.
 7. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment must clear the alarm.
 8. The time and name of the operator who acknowledged and resolved the alarm must be recorded in the database.
 9. Identical alarms from same alarm point must be acknowledged at same time the operator acknowledges the first alarm. Identical alarms must be resolved when the first alarm is resolved.
 10. Alarm functions must have priority over downloading, retrieving, and updating database from workstations and Controllers.
 11. When a reader-controlled output (relay) is opened, the corresponding alarm point must be automatically bypassed.
- I. Report Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports must be stored by type, date, and time. Report printing must be the lowest priority activity. Report generation mode must be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.
1. Printing on Requests: An operator with authorization may request a printout of any report.
 2. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.
 3. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.
 4. Who Is In (Muster) Report:

- a. Emergency Muster Report: One click operation on toolbar launches report.
 - b. Cardholder Report. Contain a count of persons that are "In" at a selected Location and a count with detailed listing of name, date, and time of last use, sorted by the last reader used or by the group assignment.
5. History Reports: Custom reports that allows the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.
- a. Initially store history on the hard disk of the host PC.
 - b. Permit viewing of the history on workstations or print history to any system printer.
 - c. The report must be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.
6. The reports of system database must be constructed so that the actual position of the printed data must closely match the position of the data on the data-entry windows.
- J. Training Software: Enables operators to practice system operation including alarm acknowledgment, alarm assessment, response force deployment, and response force communications. System must continue normal operation during training exercises and must terminate exercises when an alarm signal is received at the console.
- K. Entry-Control Enrollment Software: Database management functions that allow operators to add, delete, and modify access data as needed.
- 1. The enrollment station must not have alarm response or acknowledgment functions.
 - 2. Provide multiple, password-protected access levels. Database management and modification functions must require a higher operator access level than personnel enrollment functions.
 - 3. The program must provide means to disable the enrollment station when it is unattended to prevent unauthorized use.
 - 4. The program must provide a method to enter personnel identifying information into the entry-control database files through enrollment stations. In the case of personnel identity verification subsystems, this must include biometric data. Allow entry of personnel identifying information into the system database using menu selections and data fields. The data field names must be customized during setup to suit user and site needs. Personnel identity verification subsystems selected for use with the system must fully support the enrollment function and must be compatible with the entry-control database files.
 - 5. Cardholder Data: Provide 99 user-defined fields. System must have the ability to run searches and reports using any combination of these fields. Each user-defined field must be configurable, using any combination of the following features:
 - a. Mask: Determines a specific format that data must comply with.
 - b. Required: Operator is required to enter data into field before saving.
 - c. Unique: Data entered must be unique.
 - d. Deactivate Date: Data entered will be evaluated as an additional deactivate date for all cards assigned to this cardholder.
 - e. Name ID: Data entered will be considered a unique ID for the cardholder.
 - 6. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.
 - 7. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.

8. Batch card printing.
9. Default card data can be programmed to speed data entry for sites where most card data are similar.
10. Enhanced ACSII File Import Utility: Allows the importing of cardholder data and images.
11. Card Expire Function: Allows readers to be configured to deactivate cards when a card is used at selected devices.

2.3 SYSTEM DATABASE

- A. Database and database management software must define and modify each point in database using operator commands. Definition must include parameters and constraints associated with each system device.
- B. Database Operations:
 1. System data management must be in a hierarchical menu tree format, with navigation through expandable menu branches and manipulated with use of menus and icons in a main menu and system toolbar.
 2. Navigational Aids:
 - a. Toolbar icons for add, delete, copy, print, capture image, activate, deactivate, and muster report.
 - b. Point and click feature to facilitate data manipulation.
 - c. Next and previous command buttons visible when editing database fields to facilitate navigation from one record to the next.
 - d. Copy command and copy tool in the toolbar to copy data from one record to create a new similar record.
 3. All data entry must be automatically checked for duplicate and illegal data and must verify that data are in a valid format.
 4. Provide a memo or note field for each item that is stored in database, allowing the storing of information about any defining characteristics of the item. Memo field is used for noting the purpose the item was entered for, reasons for changes that were made, and the like.
- C. File Management:
 1. Provide database backup and restoration system, allowing selection of storage media, including CD ROM, Zip and Jaz drives, and designated network resources.
 2. Provide manual and automatic mode of backup operations. The number of automatic sequential backups before the oldest backup becomes overwritten; FIFO mode must be operator selectable.
 3. Backup program must provide manual operation from any PC on the LAN and must operate while system remains operational.
- D. Operator Passwords:
 1. Software must support up to 500 individual system operators, each with a unique password.
 2. Operator Password: One to eight alphanumeric characters Allow passwords to be case sensitive.
 3. Passwords must not be displayed when entered.
 4. Operators must use a user name and password to log on to system.

- a. This user name and password is used to access database areas and programs as determined by the associated profile.
 5. Make provision to allow the operator to log off without fully exiting program. User may be logged off but program will remain running while displaying the login window for the next operator.
- E. Security Access Integration:
1. Photo ID badging and photo verification must use same database as the security access and may query data from cardholder, group, and other personal information to build a custom ID badge.
 2. Automatic or manual image recall and manual access based on photo verification must also be a means of access verification and entry.
 3. System must allow sorting of cardholders together by group or other characteristic for a fast and efficient method of reporting on, and enabling or disabling, cards or codes.
- F. Key control and tracking must be an integrated function of cardholder data.
1. Provide the ability to store information about which conventional metal keys are issued and to whom, along with key construction information.
 2. Reports must be designed to list everyone that has possession of a specified key.
- G. Facility Codes: System must accommodate up to 2048 facility codes per Location, with the option of allowing facility codes to work at all doors or only particular doors.
- H. Operator Comments:
1. With the press of one appropriate button on toolbar, the user must be permitted to make operator comments into history at anytime.
 2. Automatic prompting of operator comment must occur before the resolution of each alarm.
 3. Operator comments must be recorded by time, date, and operator number.
 4. Comments must be sorted and viewed through reports and history.
 5. The operator may enter comments in two ways; either or both may be used:
 - a. Manually entered through keyboard data entry (typed), up to 65,000 characters per each alarm.
 - b. Predefined and stored in database for retrieval on request.
 6. System must have a minimum of 999 predefined operator comments with up to 30 characters per comment.
- I. Group:
1. Group names may be used to sort cardholders into groups that allow the operator to determine the tenant, vendor, contractor, department, division, or any other designation of a group to which the person belongs.
 2. System software must have the capacity to assign one of 32,000 group names to an access authorization.
 3. Make provision in software to deactivate and reactivate all access authorizations assigned to a particular group.
 4. Allow sorting of history reports and code list printouts by group name.

J. Time Zones:

1. Each zone consists of a start and stop time for seven days of the week and three holiday schedules. A time zone is assigned to inputs, outputs, or access levels to determine when an input must automatically arm or disarm, when an output automatically opens or secures, or when access authorization assigned to an access level will be denied or granted.
2. Up to four time zones may be assigned to inputs and outputs to allow up to four arm or disarm periods per day or four lock or unlock periods per day; up to three holiday override schedules may be assigned to a time zone.

K. Holidays:

1. Three different holiday schedules may be assigned to a time zone. Holiday schedule consists of date in format MM/DD/YYYY and a description. When the holiday date matches the current date of the time zone, the holiday schedule replaces the time zone schedule for that 24-hour period.
2. System must have the capacity for 32,000 holidays.
3. Three separate holiday schedules may be applied to a time zone.
4. Holidays have an option to be designated as occurring on the designated date each year. These holidays remain in system and will not be purged.
5. Holidays not designated to occur each year must be automatically purged from database after the date expires.

L. Access Levels:

1. System must allow for the creation up to five access levels.
2. One level must be predefined as the Master Access Level. The Master Access Level must work at all doors at all times and override any anti-passback.

M. User-Defined Fields:

1. System must provide a minimum of 99 user-defined fields, each with up to 50 characters, for specific information about each credential holder.
2. System must accommodate a title for each field; field length must be 20 characters.
3. A "Required" option may be applied to each user-defined field that, when selected, forces the operator to enter data in the user-defined field before the credential can be saved.
4. A "Unique" option may be applied to each user-defined field that, when selected, will not allow duplicate data from different credential holders to be entered.

2.4 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

1. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components must initiate a tamper-alarm signal when unit is opened

or partially disassembled. Control-station control-unit alarm display must identify tamper alarms and indicate locations.

2.5 ADMINISTRATIVE STATION HARDWARE

- A. Administrative Computer: Standard unmodified PC of modular design. The CPU communication must be 32 bytes or larger; the CPU operating speed must be at least 2 GHz.
1. Memory: 256 MB of usable installed memory, expandable to a minimum of 1024 MB without additional chassis or power supplies.
 2. Real-Time Clock:
 - a. Accuracy: Plus or minus 1 minute per month.
 3. Serial Ports: Provide two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates must be selectable under program control.
 4. Parallel Port: An enhanced parallel port.
 5. LAN Adapter Card: 100 Base T Mbps PCI bus, internal network interface card.
 6. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.
 7. Color Monitor: Not less than 19". Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.
 8. Mouse: Standard, compatible with the installed software.
 9. Disk storage must include the following, each with appropriate controller:
 - a. Minimum 160 GB hard disk, maximum average access time of 10 ms.
 - b. PCMCIA slot with removable 500 MB media.
 10. Modem: 56,600 bps, full duplex for asynchronous communications. With error detection, auto answer/autodial, and call-in-progress detection. Modem must comply with requirements in ITU-T v.34, ITU-T v.42, ITU-T v.42 Appendix VI for error correction, and ITU-T v.42 BIS-90 for data compression standards; and must be suitable for operating on unconditioned voice-grade telephone lines complying with 47 CFR 68.
 11. Audible Alarm: Manufacturer's standard.
 12. DVD-RW Drive:
 - a. Nominal storage capacity of 650 MB.
 - b. Data Transfer Rate: 1.2 Mbps.
 13. Report Printer:
 - a. Connected to the Administrative Station and designated workstations.
 - b. Laser printer with minimum resolution of 600 dpi.
 - c. RAM: 2 MB, minimum.
 - d. Printing Speed: Minimum 12 pages per minute.
 - e. Paper Handling: Automatic sheet feeder with 250 -sheet paper cassette and with automatic feed.
- B. UPS: Self-contained; complying with requirements in Division 26 Section "Static Uninterruptible Power Supply."
1. Size: Provide a minimum of 1 hours of operation of the central-station equipment, including one hour of alarm printer operation.
 2. Batteries: Sealed, valve regulated, recombinant, lead calcium.

3. Accessories:

- a. Transient voltage suppression.
- b. Input-harmonics reduction.
- c. Rectifier/charger.
- d. Battery disconnect device.
- e. Static bypass transfer switch.
- f. Internal maintenance bypass/isolation switch.
- g. External maintenance bypass/isolation switch.
- h. Output isolation transformer.

2.6 FIXED MAP DISPLAY

- A. A fixed map display must show layout of the protected facilities and displayed on the VGUI system. Zones corresponding to those monitored by system must be highlighted on the display.

2.7 CONTROLLERS

- A. Controllers: Match owners existing systems for integration. Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Master Control or workstation for controlling its operation.
- B. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.
- C. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.
- D. Alarm Annunciation Controller:
 - 1. The Controller must automatically restore communication within 10 seconds after an interruption with the field device network with dc line supervision on each of its alarm inputs.
 - a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
 - b. Alarm-Line Supervision:
 - 1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment[by monitoring for abnormal open, grounded, or shorted conditions using dc change measurements.
 - c. Outputs: Managed by Master Control VGUI/PLC software as shown on Drawings.
 - 2. Auxiliary Equipment Power: A GFI service outlet inside the Controller enclosure.
 - 3. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.
 - a. Backup Power Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.

- b. Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits.
 - 1) Trouble Alarm: Normal power off load assumed by battery.
 - 2) Trouble Alarm: Low battery.
 - 3) Alarm: Power off.

2.8 CARD READERS

- A. Power: Match owners existing. Card reader must be powered from its associated Controller, including its standby power source.
- B. Response Time: Card reader must respond to passage requests by generating a signal that is sent to the Controller. Response time must be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- C. Enclosure: Suitable for surface, semiflush, or pedestal mounting. Mounting types must additionally be suitable for installation in the following locations:
 - 1. Indoors, controlled environment.
 - 2. Indoors, uncontrolled environment.
 - 3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.
- D. Display: LED or other type of visual indicator display must provide visual and audible status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
- E. Wiegand Proximity Reader: To match controller and set up for 33 or 26-bit data cards. Comply with SIA AC-01.
 - 1. Active detection proximity card readers must provide power to compatible credential cards through magnetic induction, and must receive and decode a unique identification code number transmitted from the credential card.
 - 2. Passive detection proximity card readers must use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read must constitute a unique identification code number.
 - 3. The card reader must read proximity cards in a range from contact with to at least 6 inches from the reader.

2.9 OUTDOOR DIRECT DIAL PHONE

- A. For calls from the south gate provide Talk-a-phone single button outdoor call station. Surface mount on pedestal.
- B. Camera call up. Provide the phone with the optional auxiliary outputs for integration with the access control/CCTV systems.
- C. Fiber optic converters. IFS TT-TR3000 series.

2.10 CABLES

- A. Comply with Section 280200, Conductors and Cables for Electronic Security.
- B. Comply with manufacturer's recommended cable, and install accordingly.
- C. Elevator Travel Cable: Steel center core, with shielded, twisted pairs, No. 20 AWG conductor size.
 - 1. Steel Center Core Support: Preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60° C flame-resistant PVC and covered with a nylon or cotton braid.
 - 2. Shielded Pairs: Insulated copper conductors; color-coded, insulated with 60° C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.
 - 3. Jute Filler: Electrical grade, dry.
 - 4. Binder: Helically wound synthetic fiber.
 - 5. Braid: Rayon or cotton braid applied with 95 percent coverage.
 - 6. Jacket: 60° C PVC specifically compounded for flexibility and abrasion resistance. UL VW-1 and CSA FT1 flame rated.
- D. LAN Cabling: Comply with Section 280200, Conductors and Cables for Electronic Security and NFPA 262.
- E. Software must be designed for Microsoft Windows of same version as security access system's Master Control and workstations and must be installed on the designated PC, using a hard drive dedicated only to this management function. Hard-drive capacity must be not less than 50 GB.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project Drawings and Specifications and publish as Project planning documents for review and approval.
 - 1. Record setup data for control station and workstations.

2. For each Location, record setup of Controller features and access requirements.
 3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 4. Set up groups, facility codes, linking, and list inputs and outputs for each Controller.
 5. Assign action message names and compose messages.
 6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 7. Prepare and install alarm graphic maps on VGUI at Master Control Stations.
 8. Discuss badge layout options; design badges.
 9. Complete system diagnostics and operation verification.
 10. Prepare a specific plan for system testing, startup, and demonstration.
 11. Develop acceptance test concept and, on approval, develop specifics of the test.
 12. Develop cable and asset management system details; input data from construction documents. Include system schematics and Visio Technical Drawings.
- D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.
- 3.3 GROUNDING
- A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."
 - B. Bond shields and drain conductors to ground at only one point in each circuit.
- 3.4 INSTALLATION
- A. Install all devices in strict accordance with manufacturer's instructions.
- 3.5 SYSTEM SOFTWARE
- A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.
 - B. The Contractor will provide all software configuration files for all and any software utilized on the project
- 3.6 FIELD QUALITY CONTROL
- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 - B. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:
 - C. Perform the following field tests and inspections and prepare test reports:
 1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial

Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.

2. Test each circuit and component of each system. Tests must include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup must be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

D. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system.

B. Develop separate training modules for:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

END OF SECTION 281700

SECTION 323100 – SECURITY FENCING AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor and materials necessary for installation of fence system and gates.
- B. Related Sections:
 - 1. Section 033000, Cast in Place Concrete.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
2. ASTM B117, Practice for Operating Salt-Spray (Fog) Apparatus.
3. ASTM D523, Test Method for Specular Gloss.
4. ASTM D822, Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
5. ASTM D1654, Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
6. ASTM D2244, Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
7. ASTM D2794, Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
8. ASTM D3359, Test Method for Measuring Adhesion by Tape Test.

B. Quality Assurance:

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (retention of coating) over 90% of test area (tape and knife test).
Corrosion Resistance	B117 & D1654	Corrosion Resistance over 3,500 hours (scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact resistance over 60 inch lb. (toward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60° Method)	Weathering resistance over 1,000 hours (failure mode is 60% loss or color variance of more than 3 delta-E color units).

1.3 SUBMITTALS

- A. Product Data: Provide complete product data for all items specified.
- B. Shop Drawings: Provide sections and elevations including concrete footings for security fencing and gates.

1.4 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at Project site, inspect all materials to ensure that no damage occurred during shipping or handling. Store materials to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Impasse Gauntlet Security Fencing with three horizontal rails manufactured by Ameristar Fence Products (ameristarfence.com) or approved equal.
 - 1. Provide Impasse Gauntlet style for gate.
- B. Subject to compliance with Specifications, products from these manufacturers may be submitted:
 - 1. Betafence (betafenceusa.com).
- C. Entire fence system, and all gates, accessories, fittings, and fasteners are from a single source.

2.2 MATERIALS

- A. Galvanize steel material for fence corrugated pales, rails, and posts prior to forming. Conform to ASTM A 924 with minimum yield strength of 45,000 psi. Steel is hot-dip galvanized to confirm ASTM A653 with minimum zinc coating weight of 0.90 oz/ft². Coating Designation: G-90.
- B. The galvanized framework has a thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including six-stage pretreatment/wash (with zinc phosphate), electrostatic spray application of epoxy base, and separate electrostatic spray application of polyester finish. Base coat is thermosetting epoxy powder coating, 2 mils thick. Topcoat is black TGIC polyester powder coat finish, minimum 2 mils thick. Stratification-coated framework meets performance requirements of each quality characteristic shown in Table 1.
- C. Corrugated pales have nominal material thickness of 0.075 inches. Cross-sectional rails are nominal thickness 0.100 inches. Tamperproof fasteners fasten each pale to each rail. Posts are nominal thickness 0.100 inches (0.200 inch effective wall thickness).

2.3 FABRICATION

- A. Pales, rails and posts are pre-cut to specified lengths. Rails are pre-punched to accept tamperproof security fasteners.
- B. Completed panels are capable of supporting 400 pound load applied at midspan without permanent deformation. Panels are biasable to 30° change in grade.
- C. All rail and upright intersections of gates are joined by welding. All picket and rail intersections are joined by welding.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Fence posts for 8 foot nominal spans are set 96 inches on center, plus or minus ½ inch. Gate posts spaced according to gate openings shown in Drawings.

3.2 CLEANING

- A. Clean site of excess materials and debris.

END OF SECTION 323100

SECTION 323160 – SLIDING GATE OPERATORS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pre-wired, self-contained, slide gate operators for horizontal sliding gates, including all selected attachments and accessory equipment.
- B. Related Section:
 - 1. Section 323100, Security Fences and Gates.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's complete product data for each product.
- B. Shop Drawings: Show connections to adjacent construction, range of travel, and all electrical connections to operators. Show size and location of concrete pads and underground electrical wiring.
- C. Installation Instructions: Submit two copies of manufacturer's installation instructions for this Project.
- D. Test Reports:
 - 1. Submit affidavits from manufacturer demonstrating that gate mechanism has been tested to 200,000 cycles without failure.
 - 2. Each operator must bear a label indicating that operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components, and electrical tests of all overload devices.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture of gate operators of type specified, with minimum ten years experience.
- B. Installer: A minimum of three years experience installing similar equipment, and certified by manufacturer.

1.4 CODES AND REGULATORY REQUIREMENTS

- A. Operators: Built to UL325 standard and listed by UL or other qualified testing laboratory. Complete all electrical work according to local codes and National Electrical Code.
- B. Multiple external sensors capable of reversing gate in either direction upon sensing an obstruction.

1.5 PRODUCT DELIVERY AND STORAGE

- A. Store products upright in original shipping containers, covered, ventilated and protected from all weather conditions.

1.6 WARRANTY

- A. Provide a five year warranty against all defects in materials or workmanship. Replace defective materials with comparable materials furnished by manufacturer, at no cost to Owner.
- B. Warranty period begins on date of Substantial Completion.

PART 2 – PRODUCTS

2.1 GATE OPERATORS

- A. Basis of Design: Hy-Security Gate Operators SlideDriver 50VF2 with Smart Touch Controler, or approved equal.

2.2 OPERATION

- A. Operation is by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors are hydraulic, geroller type, and system has no belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate. The operator generates a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator is capable of operating gate panels weighing up to 4000 pounds. Gate panel velocity is 26inches per second minimum and decelerates before stop to prevent shock loads to gate and operator assembly. The soft stop feature of the gate operator is controlled by two adjustable hydraulic brake valves (one for each direction). The soft start feature allows the pump to start at zero pressure, then progressively increase pressure, over period of two seconds, to 1,000 psi.
- B. Standard Mechanical Components.
 1. Supporting Arms: Cast aluminum channel. Arms incorporate a fully bushed, 1-1/2" bronze bearing surface, acting on arm pivot pins.
 2. Arm Pivot Pins: 3/4" diameter, stainless steel, with integral tables for east of removal.
 3. Tension Spring: 2-1/2" heavy duty, 800 pound capacity.
 4. Tension Adjustment: Finger tightened nut, not requiring the use of tools.
 5. Drive Release: Instantly releases tension on both drive wheels, and disengages from contact with drive rail in single motion for manual operation.
 6. Limit Switches: Fully adjustable, toggle types, with plug connection to control panel.
 7. Electrical Enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
 8. Chassis: 1/4" steel base plate, and 10 gauge sides and back welded and ground smooth.
 9. Cover: 16 gauge galvanized sheet metal with a powder coat finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.
 10. Finish: Fully zinc plated with finish coat of high gloss powder coat withstanding 1000-hour salt spray test.

11. Drive Wheels: 8" diameter metal hub with polyurethane tread.
12. Drive Rail: Extruded 6061 T6, not less than 1/8" thick. Drive rail incorporates alignment pins for ease of replacement or splicing. Pins enable perfect butt splice.
13. Hydraulic Hose: 1/4" synthetic, rated to 2750 psi.
14. Hydraulic Valves: Individually replaceable cartridge type, in an integrated hydraulic manifold.
15. Hose Fittings at Manifold: Quick-disconnect type. Other hose fittings are swivel type.
16. Hydraulic Fluid: High performance type with a viscosity index greater than 375.
17. A zero to 2000-psi pressure gauge, mounted on manifold for diagnostics.
18. Hydraulic Fluid Reservoir: Formed from a single piece of metal, non-welded, powder coated on inside and outside to prevent fluid contamination.

C. Minimum Standard Electrical Components:

1. Pump Motor: 2 HP, 56C, TEFC, continuous duty motor, with service factor of 1.15, or greater.
2. Electrical power 480VAC, 3-phase.
3. All components have overload protection.
4. Controls: Smart Touch Controller Board with 128K memory containing:
 - a. Inherent entrapment sensor.
 - b. Built-in "warn before operate" system.
 - c. Built-in timer to close.
 - d. Liquid crystal display for reporting of functions.
 - e. 19 programmable output relay options.
 - f. Multiple control inputs for integration with Jail controls.
 - g. Anti-tailgate mode.
 - h. Built-in power surge/lightning strike protection.
 - i. Capable, with optional software, of logging EEPROM for trouble shooting diagnostics.
 - j. RS232 port for connection to laptop or other computer peripheral and RS485 connection of master/slave systems.
 - k. Transformer: 75 VA, non-jumpered taps, for all common voltages.
 - l. Control circuit: 24VDC.

C. Required External Sensors: Photoelectric Sensor Omron E3K installed to reverse gate in either direction upon sensing obstruction. Reno A&E, or approved equal, embedded loop vehicle detectors and loops, for safety and for free egress.

D. Provide and install KNOX key switch. Wire direct to gate operator.

E. Provide and install signal lights.

2.3 FACTORY TESTING

- A. Fully assemble and test each gate operator to assure smooth operation, sequencing and electrical connection integrity. Apply physical loads to operator to simulate field conditions. Tests simulate physical and electrical loads equal to fully rated capacity of operator components.
- B. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity. Check welded corners and edges to assure they are square

and straight.

- C. Inspect powder coat finish for completeness and gloss. Touch up imperfections before shipment.
- D. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

- A. Locate concrete mounting pad in accordance with reviewed Shop Drawings.
- B. Make sure gate manually operates smoothly before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding.

3.2 INSTALLATION

- A. Install gate operator in accordance with manufacturer's printed instructions. Coordinate locations of operators with Drawings, other trades and Shop Drawings.

3.3 FIELD QUALITY CONTROL

- A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for correct at-rest gate position.
- B. Fully conceal all anchor bolts in the finished installation.

3.4 TRAINING

- A. Provide four copies of operation and maintenance manual, complete with parts inventory, for Owner's use.
- B. Provide four hours of training to Owner personnel in maintenance and use of gate operators. Record training sessions and provide DVDs to Owner for future training.

END OF SECTION 323160

Calculations for

Job: Foundations - Tempe Johnny G. Martinez Water Treatment Plant

Address: SWC E. Campo Allegre Ln and N. 68th Street
Tempe, AZ 85281
(These calculations apply to the job at this address only)

Client: Durrant

Job Number: 210066

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7 – 15	Light Pole Foundation
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24 – 29	Security Fence & Gate Foundations
30 – 41	Alternate Mat Foundations



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Phoenix Seattle Everett Tacoma Lacey Portland Eugene Sacramento San Francisco Walnut Creek Los Angeles
Pasadena Long Beach Boise Irvine San Diego St. Louis New York City Amman Abu Dhabi



V. Wind Loads - Other Structures:

Importance Factor = 1.00
 Gust Effect Factor (G) = 0.85
 Kzt = 1.00
 Wind Speed 90 mph
 Exposure C

A. Solid Freestanding Walls & Solid Signs (& open signs with less than 30% open)

Dist to sign top (h)	8.0 ft	s/h =	1.00	Case A & B
Height (s)	8.0 ft	B/s =	25.00	C _r = 1.30
Width (B)	200.0 ft	Lr/s =	0.00	F = q _z G C _f A _s = 16.5 As
Wall Return (Lr)	0.0 ft	Kz =	0.849	A _s = 10.0 sf
Directionality (Kd)	0.85	qz =	15.0 psf	F = 165 lbs
Percent of open area to gross area	0.0%	Open reduction factor =	1.00	Case C
		Case C reduction factors		Horiz dist from windward edge
		Factor if s/h > 0.8 =	0.80	C _f
		Wall return factor for C _f at 0 to s =	1.00	F = q _z G C _f A _s (psf)
				0 to s
				s to 2s
				2s to 3s
				3s to 4s
				4s to 5s
				5s to 10s
				>10s

FENCE:

B. Open Signs & Lattice Frameworks (openings 30% or more of gross area)

Height to centroid of A _f (z)	4.0 ft	Kz =	0.849
Width (zero if round)	0.3 ft	Base pressure (q _z) =	15.0 psf
Diameter (zero if rect)	0.0 ft	F = q _z G C _r A _r =	20.3 Af
Percent of open area to gross area	50.0%	Solid Area: A _r =	1.0 sf
Directionality (Kd)	0.85	F =	20 lbs
		ε =	0.5
		C _r =	1.6

USE:
20 psf

C. Chimneys, Tanks & Similar Structures

Height to centroid of A _f (z)	20.0 ft	Kz =	0.902
Cross-Section	Round	Base pressure (q _z) =	17.8 psf
Directionality (Kd)	0.95	h/D =	40.00
Height (h)	20.0 ft	1/(q _z) ^{0.5} =	2.11
Width (D)	0.5 ft		
Type of Surface	Very rough (D/D=0.08)		
		Round	
		C _r =	1.20
		F = q _z G C _r A _r =	18.1 Af
		A _r =	10.0 sf
		F =	181 lbs

USE:
18 psf

POLES:

D. Trussed Towers

Height to centroid of A _f (z)	15.0 ft	Kz =	0.849
ε =	0.27	Base pressure (q _z) =	17.6 psf
Tower Cross Section	square		
Member Shape	flat	Diagonal wind factor =	1.2
Directionality (Kd)	1.00	Round member factor =	1.000

Square (wind along tower diagonal)

C_f = 3.24
 F = q_z G C_f A_f = 48.5 Af
 Solid Area: A_f = 10.0 sf
 F = 485 lbs

Square (wind normal to face)

C_r = 2.70
 F = q_z G C_r A_f = 40.4 Af
 Solid Area: A_f = 10.0 sf
 F = 404 lbs

VI. Seismic Loads: ASCE 7-05

Occupancy Category: II
 Importance Factor (I): 1.00
 Site Class: B

MOSTLY ROCK

Ss (0.2 sec) = 19.00 %g
 S1 (1.0 sec) = 6.20 %g

PER USGS, ATTACHED

Fa = 1.000
 Fv = 1.000

Sms = 0.190
 Sm1 = 0.062

$S_{DS} = 0.127$
 $S_{D1} = 0.041$

Design Category = A
 Design Category = A

Seismic Design Category = A

Number of Stories: 3

Structure Type: Not applicable

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes

Building System: **Bearing Wall Systems**

Seismic resisting system: **Intermediate reinforced masonry shear walls**

System Building Height Limit: **Height not limited**

Actual Building Height (hn) = 30.0 ft

DESIGN COEFFICIENTS AND FACTORS

Response Modification Factor (R) = 3.5
 System Over-Strength Factor (Ω_o) = 2
 Deflection Amplification Factor (Cd) = 2.25
 $S_{DS} = 0.127$
 $S_{D1} = 0.041$

Seismic Load Effect (E) = $\rho Q_E \pm 0.2S_{DS}D$ = $\rho Q_E \pm 0.025D$
 Special Seismic Load Effect (E) = $\Omega_o Q_E \pm 0.2S_{DS}D$ = $2.0 Q_E \pm 0.025D$

ρ = redundancy coefficient
 Q_E = horizontal seismic force
 D = dead load

PERMITTED ANALYTICAL PROCEDURES

Index Force Analysis (Seismic Category A only) - Minimum lateral force $F_x = 0.01W_x$ at each floor level

Simplified Analysis Use Equivalent Lateral Force Analysis

Equivalent Lateral-Force Analysis - Permitted

Building period coef. (C_T) = 0.020 $C_u = 1.70$
 Approx fundamental period (T_a) = $C_T h_n^x = 0.256 \text{ sec}$ $x = 0.75$ $T_{max} = C_u T_a = 0.436$
 User calculated fundamental period (T) = 0 sec Use T = 0.256
 Long Period Transition Period (TL) = ASCE7 map = 6
 Seismic response coef. (Cs) = $S_{Ds}/R = 0.036$
 need not exceed Cs = $S_{D1}/RT = 0.046$
 but not less than Cs = 0.010
 USE Cs = 0.036
 Design Base Shear $V = 0.036W$

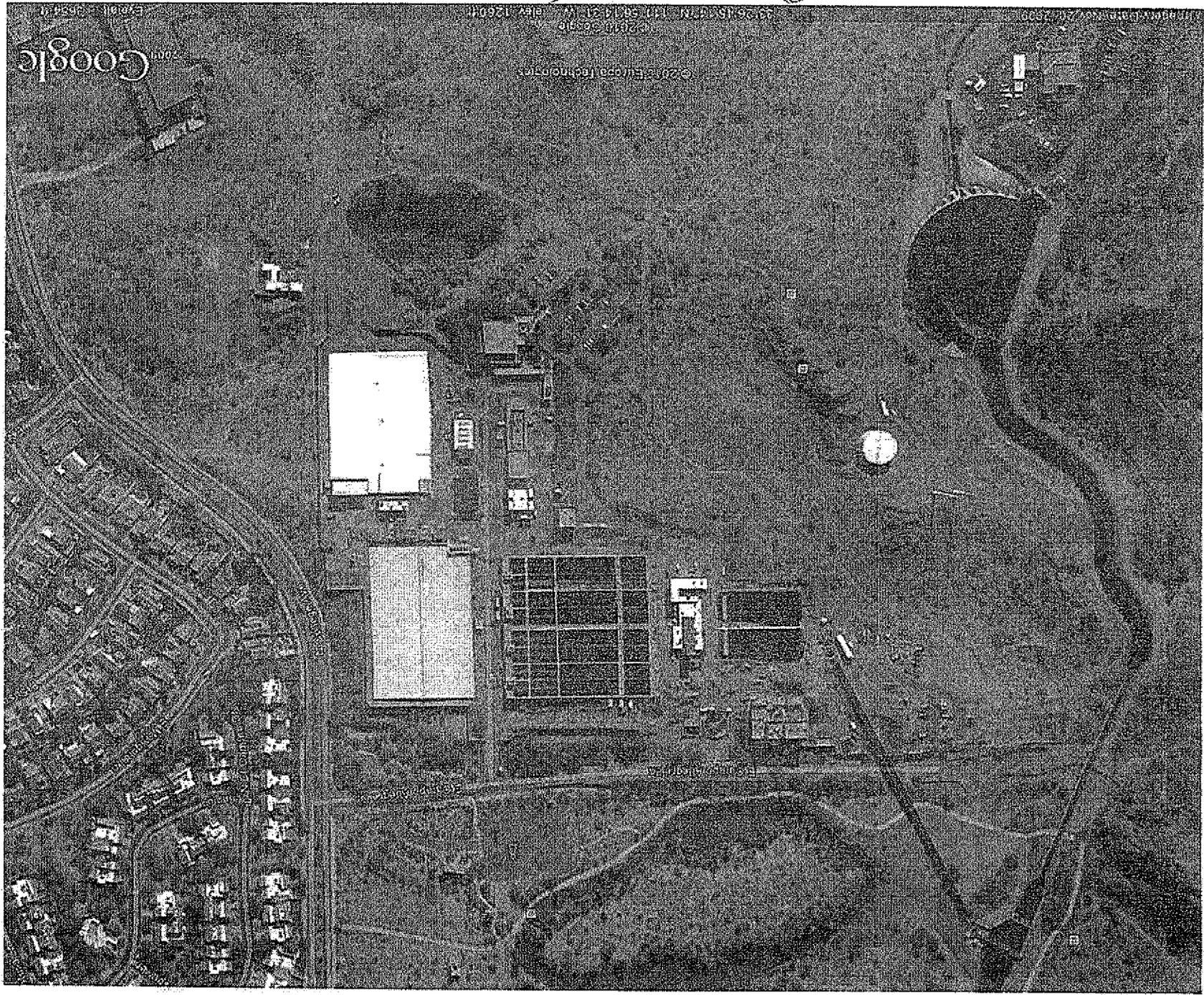
Model & Seismic Response Analysis - Permitted (see code for procedure)

ALLOWABLE STORY DRIFT

Structure Type: All other structures
 Allowable story drift = $0.020h_{sx}$ where h_{sx} is the story height below level x

33°26'45" 111°56'14" = 33.4458°, -111.9372°

4



JG Martinez

5

Conterminous 48 States

2006 International Building Code

Latitude = 33.4458

Longitude = -111.9372

Spectral Response Accelerations Ss and S1

Ss and S1 = Mapped Spectral Acceleration Values

Site Class B - Fa = 1.0, Fv = 1.0

Data are based on a 0.05000000074505806 deg grid spacing

Period Sa

(sec) (g)

0.2 0.187 (Ss, Site Class B)

1.0 0.062 (S1, Site Class B)

~~Conterminous 48 States~~

~~2006 International Building Code~~

~~Latitude = 33.4458~~

~~Longitude = -111.9372~~

~~Spectral Response Accelerations Ss and S1~~

~~Ss and S1 = Mapped Spectral Acceleration Values~~

~~Site Class B - Fa = 1.0, Fv = 1.0~~

~~Data are based on a 0.05000000074505806 deg grid spacing~~

~~Period Sa~~

~~(sec) (g)~~

~~0.2 0.187 (Ss, Site Class B)~~

6

VI. Seismic Loads - cont. :

Seismic Design Category (SDC)= A

I = 1.00

S_{ds} = 0.127

CONNECTIONS

Force to connect smaller portions of structure to remainder of structure

$F_p = 0.133 S_{ds} w_p =$ N/A w_p
 or $F_p = 0.5 w_p =$ 0.05 w_p Use $F_p =$ 0.05 w_p $w_p =$ weight of smaller portion

Beam, girder or truss connection for resisting horizontal force parallel to member

$F_p =$ no less than 0.85 times dead plus live load vertical reaction

Anchorage of Concrete or Masonry Walls to elements providing lateral support

$F_p =$ 0.050 W_w

but F_p shall not be less than 280 plf

MEMBER DESIGN

Bearing Walls and Shear Walls (out of plane force)

$F_p = 0.4 I S_{ds} w_w =$ N/A w_w
 or $F_p = 0.1 w_w =$ N/A w_w Use $F_p =$ N/A w_w

Diaphragms

$F_p = 0.01 W_p + V_{px} =$ 0.010 $W_p + V_{px}$

ARCHITECTURAL COMPONENTS SEISMIC COEFFICIENTS

Seismic Design Category A, therefore
Not required

Architectural Component : Appendages and Ornamentations

Importance Factor (I_p) : 1.0

Component Amplification Factor (a_p) = 2.5

$h =$ 8.0 feet

Comp Response Modification Factor (R_p) = 2.5

$z =$ 8.0 feet

$z/h =$ 1.00

$F_p = 0.4 a_p S_{ds} I_p W_p (1+2z/h)/R_p =$ 0.152 W_p
 not greater than $F_p = 1.6 S_{ds} I_p W_p =$ 0.203 W_p
 but not less than $F_p = 0.3 S_{ds} I_p W_p =$ 0.038 W_p

use $F_p =$ 0.152 W_p

FENCE

MECH AND ELEC COMPONENTS SEISMIC COEFFICIENTS

Seismic Design Category A, therefore
not required

Mech or Electrical Component : Lighting fixtures.

Importance Factor (I_p) : 1.0

Component Amplification Factor (a_p) = 1

$h =$ 20.0 feet

Comp Response Modification Factor (R_p) = 1.5

$z =$ 20.0 feet

$z/h =$ 1.00

$F_p = 0.4 a_p S_{ds} I_p W_p (1+2z/h)/R_p =$ 0.101 W_p
 not greater than $F_p = 1.6 S_{ds} I_p W_p =$ 0.203 W_p
 but not less than $F_p = 0.3 S_{ds} I_p W_p =$ 0.038 W_p

use $F_p =$ 0.101 W_p

LIGHTING POLES

project	JG Martinez WTP	by	NM.	sheet no.	7
date	10/12/00	rev	10	job no.	210066
task	LIGHT POLE FNDN	rev			
	IBC 2003/2000 ASCE-7	rev			

LIGHT POLE FOUNDATION

LIGHTS: $17 \times 25^{\#} + 25^{\#} = 50^{\#}$ est. *see attached product in 50*
 $17 \times 1' \times 1' = 2.115 \text{ SF}$
 POLE: $20' \times 15 \text{ plf} = 300^{\#}$
 $\frac{50^{\#}}{12} = 0.50^{\#}/\text{LF area}$
 5" dia pipe

WIND:

$P = 18 \text{ psf}$ (see following sheets)
 $P_1 = 18 \times 2.11 = 38^{\#}$
 $P_2 = 18 \times 0.50 \times 20' = 180^{\#}$ EP = $218^{\#}$ controls
 plf

SEISMIC:

$V = 0.101 W_p$ (see following sheets)

$P_1 = 0.101 \times 50^{\#} = 5^{\#}$

$P_2 = 0.101 \times 300^{\#} = 30^{\#}$ EP = $35^{\#}$

- GEOTECH REPORT:

ALLOWABLE PASSIVE PRESS. = 6000 psf

MAX. PASSIVE = 4000 psf

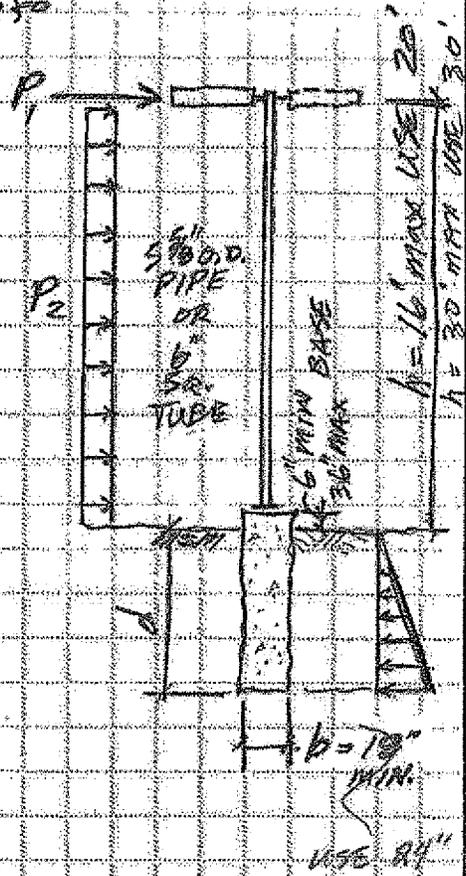
Per "Pole Embedment in Soil" spreadsheet attached: $18" \phi \times 3.125'$ USE: 24"

- h = 20' MAX: USE: $18" \phi \times 3'-6"$ EMBED

- h = 30' MAX: USE: $18" \phi \times 4'-0"$ EMBED

Found. Reinforcement: $\frac{1}{2} \times 18" \times \frac{\pi 18^2}{4} = 1.27 \text{ in}^2 \rightarrow \#5 = 0.31 \Rightarrow \textcircled{6} \#5 = 1.84 \text{ k}$

USE $\textcircled{6} \#5$ VERTS w/ $\#3$ TIES @ 12" O.C.





Pole Footing Embedded in Soil

File: S:\2010\jobs\210066 Tempe Water Treatment Security Upgrades\1-Design Phase\Calculations\enercalc.ecp
 ENERCALC, INC. 1983-2009, Ver. 6.1.02

Project: KW06000128

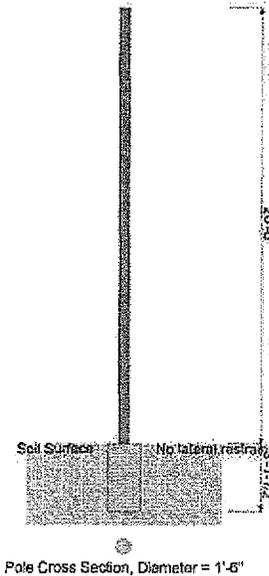
License Owner: kpf consulting engineers

Description: JGM - H=20' Light Pole Foundation (w/Soil Report)

General Information

Code References: 2006 IBC 1805.7.2, 1997 UBC 1806.8.2.1

Pole Footing Shape: Circular
 Footing Diameter: 18.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive: 600.0 pcf
 Max Passive: 4,000.0 psf



Controlling Values

Governing Load Combination: +D+W+H
 Lateral Load: 0.2180 k
 Moment: 2.560 k-ft
 NO Ground Surface Restraint
 Pressures at 1/3 Depth
 Actual: 596.39 psf
 Allowable: 600.36 psf

Minimum Required Depth: 3.125 ft

Footing Base Area: 1.767 ft²
 Maximum Soil Pressure: 0.0 ksf

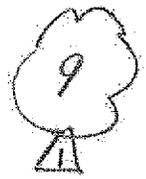
Assumes footing is square

Applied Loads

Lateral Concentrated Load		Lateral Distributed Load		Applied Moment		Vertical Load	
D: Dead Load	k		k/ft		k-ft		k
Lr: Roof Live	k		k/ft		k-ft		k
L: Live	k		k/ft		k-ft		k
S: Snow	k		k/ft		k-ft		k
W: Wind	0.0380 k		0.0090 k/ft		k-ft		k
E: Earthquake	k		k/ft		k-ft		k
H: Lateral Earth	k		k/ft		k-ft		k
Load distance above Base	20.0 ft		TOP of Load above ground				
			20.0 ft				
			BOTTOM of Load above ground				
			ft				

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth	
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)
+D+L+H	0.0	0.0	0.13	0.0	0.0
+D+Lr+H	0.0	0.0	0.13	0.0	0.0
+D+W+H	0.2	2.6	3.13	596.4	600.4
+D+0.750Lr+0.750L+0.750W+H	0.2	1.9	2.75	538.9	541.9
+D+0.750L+0.750S+0.750W+H	0.2	1.9	2.75	538.9	541.9
+0.60D+W+H	0.2	2.6	3.13	596.4	600.4



Pole Footing Embedded in Soil

File: S:\2010\Jobs\210066 Tempe Water Treatment Security Upgrades\1-Design Phase\Calculations\enercalc.ecb

ENERCALC, INC. 1983-2009, Ver: 6.1.02

Job: 210066

Client: Owner: Kofit Consulting Engineers

Description: JGM - H=30' Light Pole Foundation (w/Soil Report)

General Information

Code References: 2006 IBC 1805.7.2, 1997 UBC 1806.8.2.1

Pole Footing Shape: Circular
 Footing Diameter: 18.0 in.
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive: 600.0 pcf
 Max Passive: 4,000.0 pcf

Controlling Values

Governing Load Combination: +D+W+H
 Lateral Load: 0.3080 k
 Moment: 5.190 k-ft

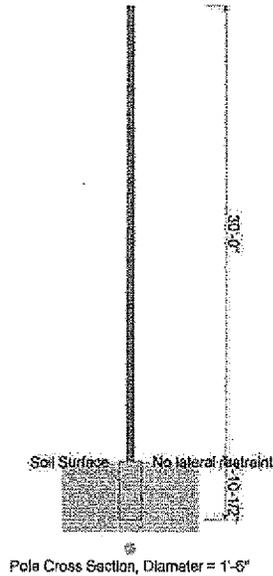
NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual: 751.80 psf
 Allowable: 752.12 psf

Minimum Required Depth: 3.875 ft

Footing Base Area: 1.767 ft²
 Maximum Soil Pressure: 0.0 ksf

Assumes footing is square



Applied Loads

Lateral Concentrated Load		Lateral Distributed Load		Applied Moment		Vertical Load	
D: Dead Load	0.0 k	0.0 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
Lr: Roof Live	0.0 k	0.0 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
L: Live	0.0 k	0.0 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
S: Snow	0.0 k	0.0 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
W: Wind	0.0380 k	0.0090 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
E: Earthquake	0.0 k	0.0 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
H: Lateral Earth	0.0 k	0.0 k/ft	0.0 k-ft	0.0 k-ft	0.0 k	0.0 k	0.0 k
Load distance above Base	30.0 ft	TOP of Load above ground	30.0 ft	BOTTOM of Load above ground	0.0 ft		

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth	
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)
+D+L+H	0.0	0.0	0.13	0.0	0.0
+D+Lr+H	0.0	0.0	0.13	0.0	0.0
+D+W+H	0.3	5.2	3.88	751.8	752.1
+D+0.750Lr+0.750L+0.750W+H	0.2	3.9	3.50	676.0	681.4
+D+0.750L+0.750S+0.750W+H	0.2	3.9	3.50	676.0	681.4
+0.60D+W+H	0.3	5.2	3.88	751.8	752.1

10



RICKER • ATKINSON • McBEE • MORMAN & ASSOCIATES, INC.
Geotechnical Engineering • Construction Materials Testing

City of Tempe
Engineering Division
P.O Box 5002
Tempe, Arizona 85280

October 12, 2010

Attention: Ken Halloran

Subject: Geotechnical Engineering Report
Security Fences and Lighting
Johnny G. Martinez Water Treatment Plant
255 East Marigold Lane
Tempe, Arizona

RAMM Project No. G18113
Supplement No. 2

At the request of Nick McLaine with KPFF Consulting Engineers, Inc., this letter presents additional foundation recommendations for the proposed Security Fences and Lighting for the Johnny G. Martinez Water Treatment Plant, located in Tempe, Arizona. Small diameter drilled piers are being considered for support of the proposed fences and light poles.

Our foundation recommendations are revised to include the following:

Small diameter drilled piers may be used for support of fences and light pole structures and should bear on undisturbed colluvial soil or breccia bedrock with a minimum depth of embedment of at least 3 feet into undisturbed colluvial soil and/or breccia bedrock. The drilled piers must extend through all existing fills and/or disturbed soils/bedrock. Drilled pier footings thus founded may be designed using an allowable bearing pressure of 4000 psf and an equivalent fluid lateral pressure of 600 psf/ft, to resist lateral loads. An allowable uplift capacity for the foundations may be determined by adding the foundation weight (times a factor of safety) plus a skin friction of 20.0 psf/ft (triangular distribution vertically times the unit surface area of the pile circumference). A factor of safety of 1.5 has already been applied to this skin friction. All foundation excavations should be reviewed by the geotechnical engineer, prior to placing reinforcing steel or concrete, to verify and approve bearing conditions.

JG Martinez

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KIM LIGHTING

CC/CCS 21" Post Top Mounted
Curvilinear Cutoff
 revision 10/1/08 • cc21p.pdf

Type:
 Job:
 Catalog number:

Approvals:

FM, CCS21P3

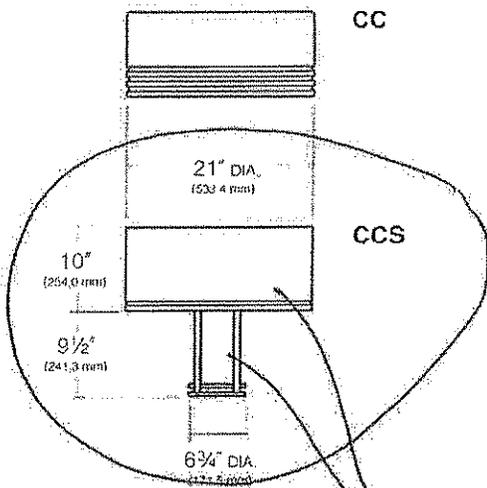
Mfg. Fixture Electrical Module Finish Options
 See page 2 See page 3 See pages 4-5

Date:
 Page: 1 of 5

Select pole from Kim Arms and Poles Selection Guide. If pole is provided by others indicate O.D. for arm fitting.

Specifications

21" Diameter
 150 to 400 Watt



A = 277 in
 = 1.92 ft
 x 1.1
 2.11 ft EPA

Housing: Spun aluminum. (Rollformed linear reveals; **CC:** Three equally spaced reveals, 1/2" wide, separated by 1/2" ribs, 1/4" deep. **CCS:** One 1/4" groove, 1/4" deep.) Sidewalls have a maximum 1° of taper, and are free of welds or fasteners. A rollformed aluminum flange is hemmed into the bottom providing support for the reflector module. An internal aluminum casting provides for mounting of the electrical module and support for the housing hinge.

Lens Frame and Yoke: One-piece cast aluminum lens frame is attached to the housing by a zinc plated cold rolled steel hinge with a stainless steel pin. Closure of the housing is by three self-retained stainless steel screws. A stainless steel self-locking stop arm is provided to hold the housing in the open position while servicing. A 3/16" thick clear flat tempered glass lens is fully gasketed by a one-piece extruded and vulcanized silicone gasket. Lens is retained in the frame by removable zinc plated steel clips. Lens frame is supported at four points by two aluminum U-shaped tubular arms cradled in a cast aluminum hub. Arms are welded to the lens frame, and welded to the hub along their longitudinal axis. Hub contains a field-splice compartment, a cast aluminum cover and one of the following pole attachment means: **FM - Flush Mounting**, **PT - Pole Top mounting**, or **DM - Direct Mounting** (See page 2 for complete descriptions).

Reflector Module: Specular Alzak® optical segments are rigidly mounted within a die-cast aluminum enclosure that attaches to the housing as a one-piece module. Reflectors are field rotatable in 90° increments. All sockets are factory prewired with a quick-disconnect plug for the ballast module. Wire penetrations to the socket are sealed by a silicone gasket to create a totally sealed optical chamber. The optical segments are positioned so that reflected light does not pass through the lamp arc tube. All HPS and PMH horizontal reflectors are equipped with a mogul base socket rated 4KV.

Electrical Module: All electrical components are UL and CSA recognized, mounted on a single plate and factory prewired with quick-disconnect plugs. Module attaches inside the housing using keyhole slots. All ballasts are high power factor with starting temperatures of -40°F for HPS and -20°F for PMH lamp modes.

Finish/Color: Finish is Super TGIC thermoset polyester powder coat paint, 2.5 mil nominal thickness, applied over a titanated zirconium conversion coating; 5000 hour salt spray test endurance rating. Standard colors are Black, Dark Bronze, Light Gray, Stealth Gray™, Platinum Silver, or White. Custom colors are available.

CAUTION: Fixtures must be grounded in accordance with national, state and/or local electrical codes. Failure to do so may result in serious personal injury.

Listings and Ratings

UL cUL 1598*	CE	IP66 Rated	25C Ambient
Full Cut Off (Flat Glass Lens Only)			

*Suitable for wet locations

*Dark Sky Legislation Compliant

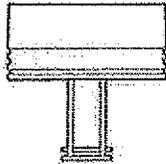
KIM LIGHTING RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE



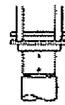
Type:

Job:

Page: 2 of 5

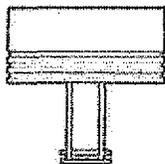


Standard Features

Mounting						
	EPA: 1.0	EPA: 1.0	EPA: 1.0			
	Cat. No.: <input checked="" type="checkbox"/> FM Flush Mount	<input type="checkbox"/> PT Pole Tenon Mount	<input type="checkbox"/> DM Direct Mount			
Pole Top Requirements:	4", 4½", 5", or 6" Dia.	2" Pipe-size Tenon (2¾" O.D. x 4¾" L)	3.1" to 3.9" Dia.			
Fixture Cat. No. designates CC/CCS fixture and light distribution. See the Kim Site/Roadway Optical Systems Catalog for detailed information on reflector design and application.	Horizontal Lamp  CC					
	 CCS					
	Light Distribution:	Type I Full Cutoff	Type II Full Cutoff	Type III Full Cutoff	Type IV Forward Throw Full Cutoff	Type V Square Full Cutoff
Cat. No.:	<input type="checkbox"/> CC21P1 <input type="checkbox"/> CCS21P1	<input type="checkbox"/> CC21P2 <input type="checkbox"/> CCS21P2	<input type="checkbox"/> CC21P3 <input type="checkbox"/> CCS21P3	<input type="checkbox"/> CC21P4 <input type="checkbox"/> CCS21P4	<input type="checkbox"/> CC21P5 <input type="checkbox"/> CCS21P5	

Type:
 Job:

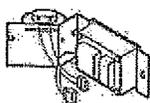
Page: 3 of 4



Standard Features

Electrical Module

HPS = High Pressure Sodium
PMH = Pulse Start Metal Halide



Lamp Watts Lamp Type Line Volts
 400 HPS 277

Cat. Nos. for Electrical Modules available:

High Pressure Sodium

- | | | |
|---|------------------------------------|------------------------------------|
| <input type="checkbox"/> 150HPS120 | <input type="checkbox"/> 250HPS120 | <input type="checkbox"/> 400HPS120 |
| <input type="checkbox"/> 150HPS208 | <input type="checkbox"/> 250HPS208 | <input type="checkbox"/> 400HPS208 |
| <input type="checkbox"/> 150HPS240 | <input type="checkbox"/> 250HPS240 | <input type="checkbox"/> 400HPS240 |
| <input type="checkbox"/> 150HPS277 | <input type="checkbox"/> 250HPS277 | <input type="checkbox"/> 400HPS277 |
| <input type="checkbox"/> 150HPS347 | <input type="checkbox"/> 250HPS347 | <input type="checkbox"/> 400HPS347 |
| <input checked="" type="checkbox"/> 150HPS480 | <input type="checkbox"/> 250HPS480 | <input type="checkbox"/> 400HPS480 |

Lamp	ED-23 1/2 Clear	ED-18 or ET-18 Clear	ED-18 or ET-18 Clear
Socket	Mogul Base	Mogul Base	Mogul Base
ANSI Ballast Type	S-55	S-50	S-51

Pulse Start Metal Halide*

- | | | | |
|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <input type="checkbox"/> 250PMH120 | <input type="checkbox"/> 320PMH120 | <input type="checkbox"/> 350PMH120 | <input type="checkbox"/> 400PMH120 |
| <input type="checkbox"/> 250PMH208 | <input type="checkbox"/> 320PMH208 | <input type="checkbox"/> 350PMH208 | <input type="checkbox"/> 400PMH208 |
| <input type="checkbox"/> 250PMH240 | <input type="checkbox"/> 320PMH240 | <input type="checkbox"/> 350PMH240 | <input type="checkbox"/> 400PMH240 |
| <input type="checkbox"/> 250PMH277 | <input type="checkbox"/> 320PMH277 | <input type="checkbox"/> 350PMH277 | <input type="checkbox"/> 400PMH277 |
| <input type="checkbox"/> 250PMH347 | <input type="checkbox"/> 320PMH347 | <input type="checkbox"/> 350PMH347 | <input type="checkbox"/> 400PMH347 |
| <input type="checkbox"/> 250PMH480 | <input type="checkbox"/> 320PMH480 | <input type="checkbox"/> 350PMH480 | <input type="checkbox"/> 400PMH480 |

Lamp	ED-28 or BT-28 Clear	ED-28 Clear	ED-28 Clear	ED-28 Clear
Socket	Mogul Base	Mogul Base	Mogul Base	Mogul Base
ANSI Ballast Type	M-138	M-154 or M-132	M-131	M-135

NOTE: For lamp/ballast information outside of the U.S.A. and Canada, please consult your local Kim representative.

CAUTION: All manufacturers of metal halide lamps recommend turning them off for 15 minutes once per week when under continuous operation. This will reduce the risk of arc tube rupture at end of life. Also, color temperature may differ between manufacturers of metal halide lamps. See lamp manufacturers' specification sheets.

NOTE: Due to the Energy Independence and Security Act (EISA) of 2007, Kim Lighting can no longer supply probe start metal halide ballasts with its luminaires, effective January 1, 2009. Contact Kim Lighting for availability of replacement ballasts for warranty service claims.
 (Visit www.aboutlightingcontrols.org or the Library of Congress website for more details).

Finish

Super TGIC powder coat paint over a titanated zirconium conversion coating.

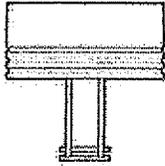
Color: Black Dark Bronze Light Gray Stealth Gray™ Platinum Silver White Custom Color²
 Cat. No.: BL DB LG SG PS WH CC

²Custom colors subject to additional charges, minimum quantities and extended lead times. Consult representative. Custom color description: _____

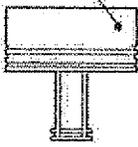
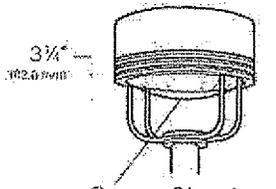
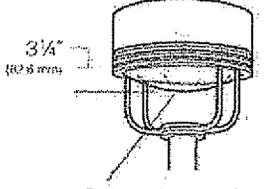
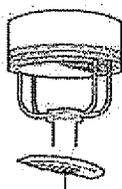
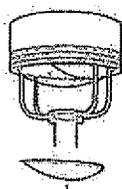
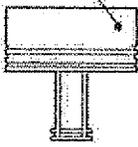
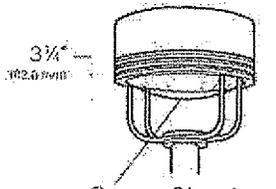
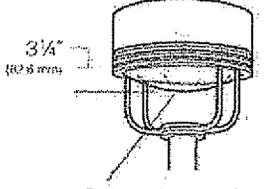
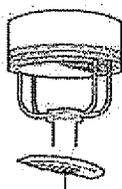
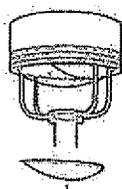
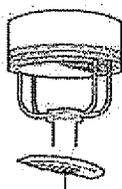
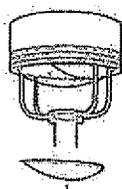
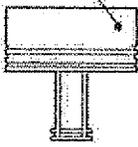
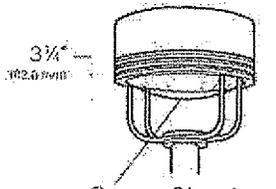
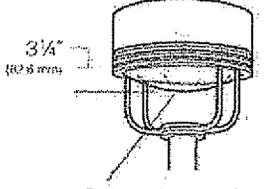
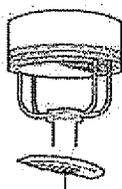
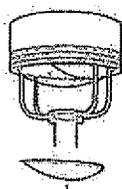
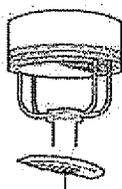
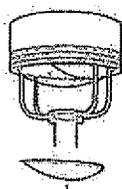
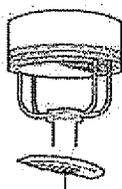
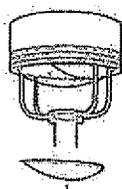
Type:

Job:

Page: 4 of 5

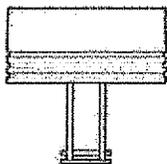


Optional Features

<p>Photocell Cat. No. (See right) <input type="checkbox"/> No Option</p>	<p>Factory installed photocell inside housing with a fully gasketed sensor on the side wall.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Cat. No. <input type="checkbox"/> A-30</td> <td style="width: 50%; border: none;">Line Volts: 120V</td> </tr> <tr> <td style="width: 50%; border: none;">Cat. No. <input type="checkbox"/> A-31</td> <td style="width: 50%; border: none;">Line Volts: 208V</td> </tr> <tr> <td style="width: 50%; border: none;">Cat. No. <input type="checkbox"/> A-32</td> <td style="width: 50%; border: none;">Line Volts: 240V</td> </tr> </table> </td> <td style="width: 50%; border: none;"> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Cat. 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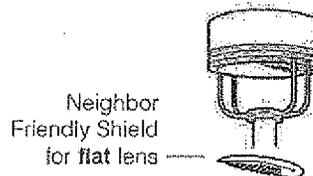
Type:
 Job:



Optional Features

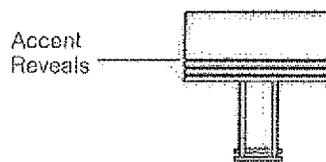
Neighbor Friendly Shield
 Cat. No. NFS
 No Option

(Type IV only) Stamped internal shield and blocking panels are used to direct and redirect lighting into a forward throw distribution. The amount of light directed and redirected toward the back of the luminaire is dramatically reduced to create extremely low glare behind the pole. Only available on the Type IV reflectors.



Accent Reveals
 Cat. No. **(See right)**
 No Option

(For CC series only.) Three aluminum bands riveted inside the housing reveals. Available in five standard Kim powder coat finishes. Custom colors available.



- Color: Black Dark Bronze Light Gray Stealth Gray™ Platinum Silver White Custom Colors¹
- Cat. No.: BL-REV DB-REV LG-REV SG-REV PS-REV WH-REV CC-REV

¹Custom colors subject to additional charges, minimum quantities and extended lead times. Consult representative. Custom color description: _____

project	JGM-CCTV	by	TSS	sheet no.	16
task	CCTV POLE FNDN	date		job no.	210066
	IBC 2003/2006 ASCE 7	rev	A		
		rev			

CCTV LIGHT POLE FOUNDATION

CCTV: $x \# + \# = 16 \#$
 $x \# = 1.2 \#$
 POLE: $20' \times 20' = 400 \#$
 $\frac{6''}{12} = 0.50 \#/ft \text{ area}$

WIND

$P = 26 \text{ psf}$ (see following sheets)
 $P_1 = 26 \times 1.2 = 32 \#$
 $P_2 = 26 \times 0.50 \times 20' = 260 \#$
 13 psf

SEISMIC

$V = 0.152 W$ (see following sheets)
 $P_1 = 0.152 \times 16 \# = 2.4 \#$
 $P_2 = 0.152 \times 200 \# = 31 \#$
 $\Sigma P = 34 \#$

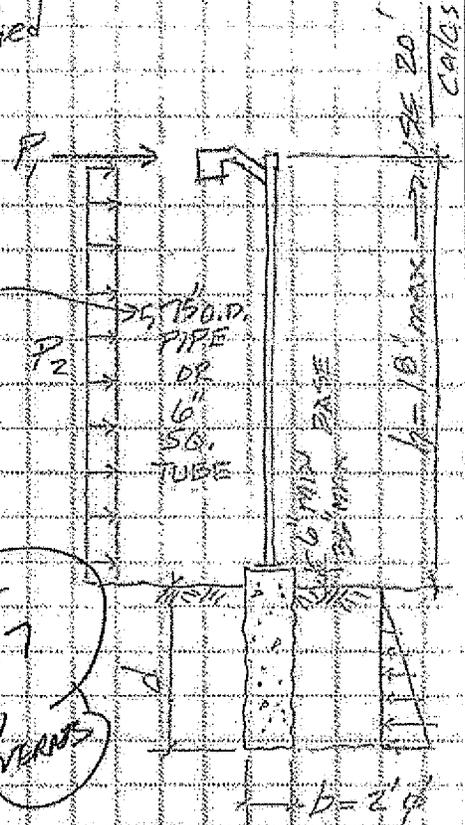
ALLOWABLE PASSIVE PRESS. = $2 \times 100 \text{ psf} = 200 \text{ psf}$ TABLE 1604.2 Cbr = 5
 MAX. PASSIVE = $15' \times 200 = 3,000 \text{ psf}$

Per "Pole Embedment in Soil" spreadsheet attached: $24 \phi \times 4 \text{ S}$

USE $24 \phi \times 6 \text{'-}0 \text{'}$ EMBEDMENT!

Found. Reinforcement: $\frac{1}{2} \times 1\% \times \frac{\pi 24^2}{4} = 2.16 \text{ in}^2 \rightarrow 5 \#6$

USE $(6) \text{ - } \#6 \text{ VERTS w/ } \#3 \text{ TIES @ } 12 \text{ D.C.}$



7" tapwater pipe, PVC -
 24" 150 D. PIPE OR 6" SQ. TUBE
 SEE LIGHT POLE PAGE 7
 SAME DESIGN COVERS LIGHT POLE COVERS

h = 20' max
 20' SE 20' CALCS

17

Project Notes :

Pole Footing Embedded in Soil

File: s:\2010\jobs\210066 Tempe Water Treatment Security Upgrades\1-Design Phase\Calculations\enercalc.ec6
 ENERCALC, INC. 1983-2009, Ver. 6.1.02

Project No: 210066 Job No: 210066 Job Title: JG Martinez and South Tempe Water Plants Job # 210066
 Project Desc: JG Martinez and South Tempe Water Plants Job # 210066
 Project Location: Phoenix, AZ
 Project Date: 2006-10-17
 Project Status: Design

Description: JGM - CCTV Pole Foundation

General Information

Pole Footing Shape: Circular
 Footing Diameter: 24.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive: 200.0 pcf
 Max Passive: 3,000.0 pcf

Controlling Values

Governing Load Combination: D+W+H
 Lateral Load: 0.2950 k
 Moment: 3.30 k-ft
 NO Ground Surface Restraint
 Pressures at 1/3 Depth
 Actual: 293.29 psf
 Allowable: 294.79 psf

Minimum Required Depth: 4.50 ft

Footing Base Area: 3.142 ft²
 Maximum Soil Pressure: 0.0 ksf

Applied Loads

Lateral Concentrated Load

D: Dead Load k
 Lr: Roof Live k
 L: Live k
 S: Snow k
 W: Wind 0.0350 k
 E: Earthquake k
 H: Lateral Earth k
 Load distance above Base 20.0 ft

Lateral Distributed Load

0.0130 k/ft
 TOP of Load above ground 20.0 ft
 BOTTOM of Load above ground ft

Applied Moment

3.30 k-ft

Vertical Load

k

SEE LIGHT POLE FOR LIGHT OVERHEADS



Pole Cross Section, Diameter = 2'-0"

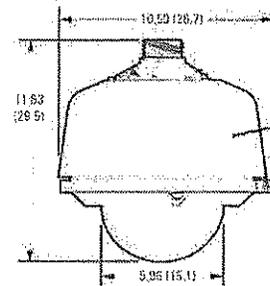
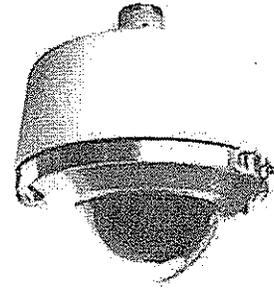
Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth	
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)
+D+L+H	0.0	0.0	0.13	0.0	0.0
+D+Lr+H	0.0	0.0	0.13	0.0	0.0
+D+W+H	0.3	3.3	4.50	293.3	294.8
+D+0.750Lr+0.750L+0.750W+H	0.2	2.5	4.00	264.3	265.3
+D+0.750L+0.750S+0.750W+H	0.2	2.5	4.00	264.3	265.3
+0.600D+W+H	0.3	3.3	4.50	293.3	294.8

Pressurized Spectra® IV SE Series BACK BOX AND LOWER DOME

Product Features

- Pressurized to 8 psig (55 kPa)
- Solid-State Sensors for Internal Temperature, Pressure, and Dew Point
- On-Demand Environmental Status Display for Internal Temperature, Pressure, and Dew Point
- On-Screen Alert Modes
- On-Screen Programmable Menus for Pan/Tilt, Camera, and Sensor Alert Settings
- Built-in Back Box Memory
- Integrated Passive UTP Circuit
- 2 Auxiliary Outputs and 7 Alarm Inputs
- Environmental Pendant Style Back Box
- Stainless Steel Construction
- Meets NEMA Type 6P and IP67 Standards
- Compatible with 27X and 35X Spectra® IV SE Dome Drives
- Built-in Power Line Surge and Limited Lightning Protection
- Fiber Optic Feedthrough Models Available



NOTE: VALUES IN PARENTHESES ARE CENTIMETERS, ALL OTHERS ARE IN INCHES

$$\begin{aligned} \Sigma A &\approx 120 \text{ in}^2 \\ &\times 1.1 \\ \hline &132 \\ &= 0.92 \\ &\text{EPA} \end{aligned}$$

Pelco's **Pressurized Spectra® IV SE Series** dome system provides ultimate protection of the camera optics and electronics from moisture, corrosive gases, and airborne contaminants. Domes are easily pressurized with dry nitrogen to 8 psig (55 kPa) before or after installation to stabilize the environment inside the system.

Sensors strategically placed in the dome system send an "Alert" message when changes in internal pressure, temperature, or dew point are beyond factory-set acceptable limits. The sensors also allow for instant on-screen display of internal temperature, pressure, and dew point.

The components of the **Pressurized Spectra IV SE Series** include an environmental pendant style back box and a lower dome designed for optimum optical clarity. All stainless steel construction provides added protection in harsh environments.

The back box features a sun shroud, heater, and fan to maintain a consistent operating environment. The back box also features built-in back box memory, an integrated passive UTP circuit, two auxiliary outputs, seven alarm inputs, and is compatible with all Spectra IV SE Series dome drives.

The lower dome features an innovative O-ring seal and a stainless steel V-band to create a reliable pressure seal. The V-band has a unique latching system with one captivated fastener making lower dome installation easy. Accessible on the lower dome trim ring are a Schrader valve for system purging and a pressure relief valve.

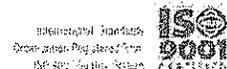
The **Pressurized Spectra IV SE Series** is supplied with a prewired cable with mating connector. The cable includes all wires for system functionality, including power, alarms, auxiliaries, coaxial video, UTP video, and serial control.

Also available are pressurized back box models with fiber optic feedthrough that allow Pelco's FS65011A and third-party fiber optic transmitters to be installed inside the back box. These models include either a 9/125 µm single-mode or 62.5/125 µm multimode fiber optic cable with an ST-type connector.

Optional diagnostic/installation tools include a remote monitor kit (IPS-AMK) and a remote monitor cable (IPS-CABLE). These accessories allow the installer to view video, control PTZ functions, and perform system setup and software upgrades at the installation site.



by Schneider Electric



02001 / REVISED 11-0-08

TECHNICAL SPECIFICATIONS

19

SYSTEM MODEL NUMBERS

Back Box Type	Lower Dome	27X Day/Night ¹	35X Day/Night ¹
Environmental Pendant, Pressurized	Smoked	SD427-PR0	SD435-PR0
	Clear	SD427-PR1	SD435-PR1
Environmental Pendant, Pressurized Fiber Optic Feedthrough, Single-Mode	Smoked	SD427-PRSL0	SD435-PRSL0
	Clear	SD427-PRSF1	SD435-PRSF1
Environmental Pendant, Pressurized Fiber Optic Feedthrough, Multimode	Smoked	SD427-PRMF0	SD435-PRMF0
	Clear	SD427-PRMF1	SD435-PRMF1

COMPONENT MODEL NUMBERS

Back Box	Lower Dome	Dome Drive*
BB4-PR-E Environmental pendant, gray, pressurized	LDE3PR-0 Lower dome with smoked bubble LDE3PR-1 Lower dome with clear bubble	DD427 Day/night (NTSC) camera (27X) DD4CBW35 Day/night (NTSC) camera (35X) DD5-FM Removable, fixed mount bracket only (camera and lens not included), interchangeable with all Spectra IV dome drives
BB4-PRS-E Environmental pendant, gray, pressurized, fiber optic feedthrough, single-mode		
BB4-PRM-E Environmental pendant, gray, pressurized, fiber optic feedthrough, multimode		

*For PAL and CCIR models add "-X" suffix to part number (for example, SD435-PRSE0-X or DD427-X)
Note: To order a fixed mount system, refer to the component models above and select a back box model, a lower dome model, and the DD5-FM dome drive. DD5-FM is ideal for use with Pelco's C100N-6, C100N-6X, C100H-6, C100H-6X, CCC1390H-6, and CCC1390H-6X cameras with selected Pelco lenses.

ELECTRICAL

Input Voltage	18 to 32 VAC, 24 VAC nominal 22 to 27 VDC, 24 VDC nominal
Input Power	24 VAC 23 VA nominal (without heater); 73 VA nominal (with heater)
24 VDC	0.7 A nominal (without heater)
Fuse	1.25 A
Auxiliary Outputs	2
Alarm Inputs	7

Weight (approximate)	Unit	Shipping
Back Box	10.2 lb (4.6 kg)	13 lb (5.9 kg)
Lower Dome	3.3 lb (1.5 kg)	7 lb (3.2 kg)

CERTIFICATIONS/RATINGS

- CE, Class B
- FCC, Class B
- UL/cUL Listed
- C-Tick
- S Mark for Argentina
- Meets NEMA Type 6P and IP67 standards

13.5 #

GENERAL

Construction	
Back Box and Lower Dome	Type 316L stainless steel
Bubble	Polycarbonate, 0.030-inch thick
Light Attenuation	1 f-stop (smoked), zero light loss (clear)
V-Band	Type 316L stainless steel
Pressure Relief	Brass
Schraeder Valve	Brass
Connector	Nickel-plated steel
Mounting	1.5-inch NPT, threaded
Pressurization	
Valve	Schrader
Pressure	8 psig (55 kPa) (not factory pressurized)
Pressure Relief	10 psig (69 kPa)
Operating Temperature	(Assumes no wind chill factor, for detailed test conditions, contact Pelco)
Maximum	140°F (60°C) absolute maximum, 122°F (50°C) sustained maximum
Minimum	-60°F (-51.1°C) absolute minimum, minimal icing at sustained minimum of -50°F (-45°C); prevents icing at sustained minimum of -40°F (-40°C), de-ices 0.1 inch (2.5 mm) within 3 hours after power-up

OPTIONAL ACCESSORIES

IPS-BMK	Remote monitor kit
IPS-CABLE	Remote monitor cable and software kit
IPS-RDPE-2	Remote data port
EH000RKIT	Dry nitrogen recharging kit (cannot be refilled)
TXB Series ¹	Translator boards for AD Manchester, Harris, Bosch ² (Philips, Burle), TASS, and NTCIP protocols
FS85011A ¹	Fiber transmitter sends one unidirectional composite video channel and one bidirectional data channel over one optical fiber. Available in multimode and single-mode versions
Mounts	IDM4012GS (stainless steel, wall), INVM Series (wall), MRCA (ceiling), PP434B (parapet roof), and PP350/PP351 (parapet wall/roof)

¹If TXB or FS85011A boards are installed, it is not possible to upgrade system operating software through the remote data port (IPS-RDPE-2)

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www.pelco.com

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SWM Series Mount

CORNER, POLE, AND WALL

Product Features

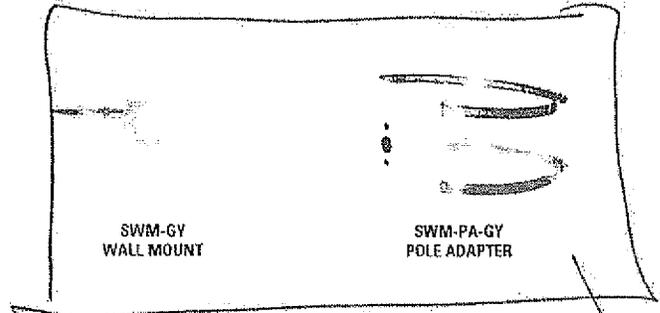
- For Use with Pelco Pendant Components (Domes, Back Boxes, and Adapters) that Require a 1.5-inch NPT Pipe Thread for Installation
- Low Cost
- Constructed of Cast Aluminum
- Cable Feedthrough Features
- Supports up to 10 lb (4.5 kg)
- Easy to Install, Using a Mounting Plate and Standard Tools
- Mounting Hardware is Concealed Within the SWM, Providing a Very Attractive Appearance
- Mounts Directly to a Vertical Load-Bearing Surface for Wall Mount Applications
- Can be used with the SWM-PA Series Pole Adapter or SWM-CA Series Corner Adapter
- For Indoor or Outdoor Applications

The **SWM Series** provides indoor and outdoor wall mounting for Pelco pendant components (domes, back boxes, and adapters) that require a 1.5-inch NPT pipe thread for installation. Its unique design conceals the mounting bolts inside the mount, providing a clean and aesthetically pleasing appearance. It is easy to install and requires no special tools. A gasket is affixed to the base to protect the interior from moisture.

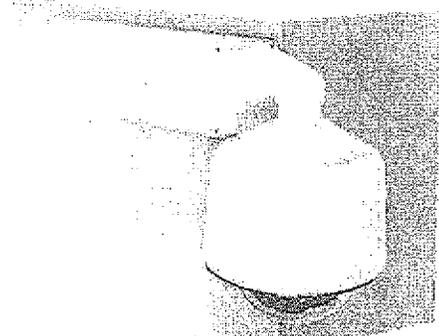
A feedthrough opening in the mounting surface allows for easy routing of video and power cables. Because of its compact size, the mount is not suitable for use with conduit fittings. A 1.5-inch NPT pipe thread is provided in the mount to attach the pendant dome.

Accessories for the wall mount include the **SWM-PA Series** pole adapter and the **SWM-CA Series** corner adapter. The corner adapter allows the wall mount to be attached to the corner of a building. The **SWM-CA24** corner adapter includes a 100 VA transformer that converts 120 or 230 VAC input to 24 VAC output to operate Spectra® and DF5 domes.

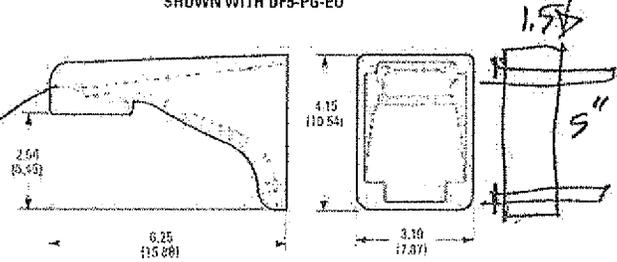
The wall mount and adapters are constructed of aluminum. The wall mount and pole adapter are available in light gray, black, or white polyester powder coat finish. The corner adapter is available in light gray or white finish.



SWM-CA CORNER ADAPTER



SWM-GY WALL MOUNT AND SWM-CA CORNER ADAPTER SHOWN WITH DF5-PG-EO



SWM-GY
NOTE: VALUES IN PARENTHESES ARE CENTIMETERS, ALL OTHERS ARE INCHES.



by Schneider Electric

$$SA \approx 26 \text{ in}^2$$

$$\times 1.1$$

$$\frac{\quad}{29}$$

$$= 10.20 \text{ g LEPA}$$

International Standards
Equivalent Registered Firm
ISO 9001
1250 / REVISED 12-8-09

TECHNICAL SPECIFICATIONS

MODELS

SWM-GY	Wall mount with cable leadthrough, gray finish
SWM-BK	Same as SWM-GY except black finish
SWM-WT	Same as SWM-GY except white finish

RELATED PRODUCTS

SWM-CA	Corner adapter, gray finish
SWM-CAWT	Same as SWM-CA except white finish
SWM-CA24	Same as SWM-CA except includes internal transformer to convert 120 or 230 VAC input to 24 VAC
SWM-PA-GY	Pole adapter with stainless steel hardware, gray finish
SWM-PA-BK	Same as SWM-PA-GY except black finish
SWM-PAWT	Same as SWM-PA-GY except white finish

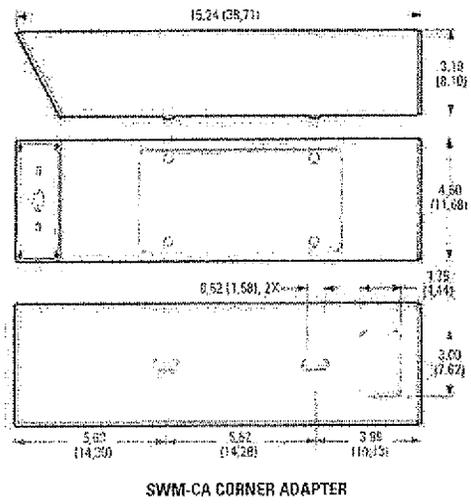
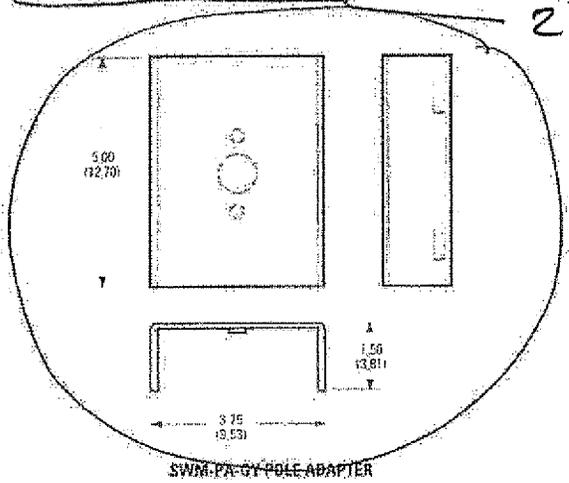
ELECTRICAL (SWM-CA24 ONLY)

Input Power	120/230 VAC, 50/60 Hz switchable
Output Power	24 VAC (100 VA transformer)
Circuit Protection	One 1.6 A, 120 VAC fast-acting fuse or one 500 mA, 230 VAC slow-blow fuse

GENERAL

Mounting Method	Wall Mount	Mount is secured by a set screw to a mounting plate that is attached to the mounting surface with two fasteners (not supplied) up to 0.25-inch (M6) diameter.
Corner Adapter	Adapter is attached to a vertical load-bearing surface with two 0.375-inch (M6) diameter stainless steel bolts of appropriate length (not supplied). Includes hardware to attach SWM mount.	
Pole Adapter	Adapter is attached to a pole with two stainless steel straps (supplied). Straps fit 4 to 8-inch (10.16 to 20.32 cm) diameter pole. Includes hardware to attach SWM mount.	
Cable Entry	Cable leadthrough holes in mount adapters	
Maximum Load	10 lb (4.5 kg)	
Environment	Indoor/outdoor	
Operating Temperature (SWM-CA24 only)	-50° to 120°F (-46° to 49°C)	
Effective Projected Area (EPA)		
SWM-GY, SWM-BK, SWM-WT	-12 square inches	
Construction		
Wall Mount	Cast aluminum	
Adapters	Aluminum	
Finish		
SWM-GY, SWM-CA, SWM-CA24, SWM-PA-GY	Gray polyester powder coat	
SWM-BK, SWM-PA-BK	Black polyester powder coat	
SWM-WT, SWM-PAWT, SWM-CAWT	White polyester powder coat	

Weight	Unit	Shipping
SWM-GY, SWM-BK, SWM-WT	1.10 lb (0.50 kg)	2 lb (0.91 kg)
SWM-CA, SWM-CAWT	3.95 lb (1.79 kg)	5 lb (2.27 kg)
SWM-CA24	7.32 lb (3.32 kg)	9 lb (4.08 kg)
SWM-PA-GY, SWM-PA-BK, SWM-PAWT	0.70 lb (0.32 kg)	2 lb (0.91 kg)



NOTE: VALUES IN PARENTHESES ARE CENTIMETERS, ALL OTHERS ARE INCHES.

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 www.pelco.com

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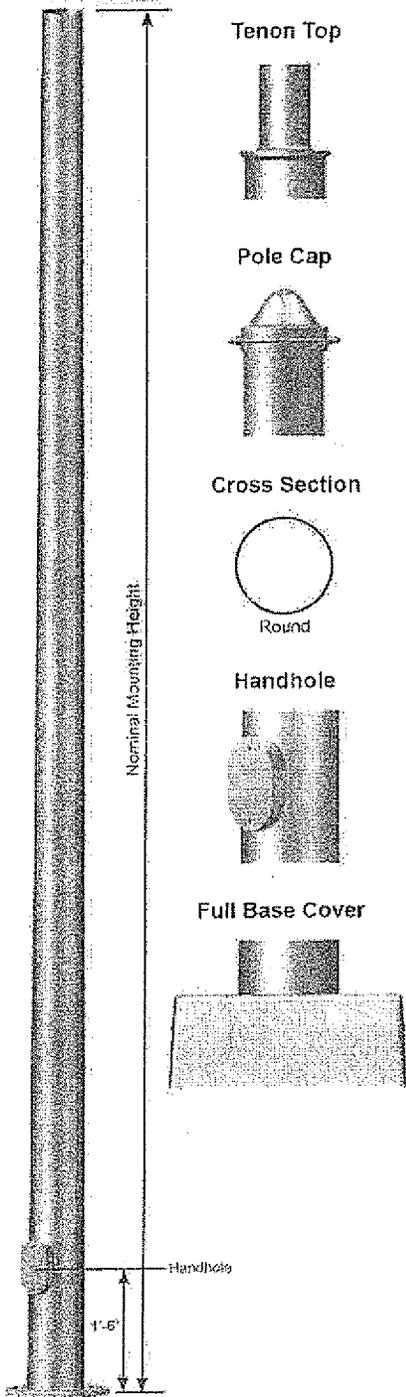
21

2*

Job Name _____	Client Name _____
Job Location - City: _____ State: _____	Created By _____ Date: _____
Product: DS210 _____ Quote: _____	Customer Approval _____ Date: _____

Poles - Steel
RTS / DS210
Light Duty

SPECIFICATIONS



Pole - The pole shaft conforms to ASTM A595 Grade A or A572 Grade 55 with a constant linear taper of 0.14 in/ft. Pole can be either a one-piece or two-piece field assembled unit.

Pole Top - A pole top plate and tenon are provided for top mount luminaire and/or bracket. A removable pole cap is provided for poles receiving drilling patterns for side-mount luminaire arm assemblies.

Handhole - A covered handhole and grounding provision with hardware is provided.

Full Base Cover - The two-piece standard full base cover is fabricated from ABS plastic. Valmont reserves the right to provide an optional two-piece steel full base cover on some applications depending upon the finish requirement and/or pole base diameter.

Nut Covers - Optional anchor bolt nut covers are available upon request.

Anchor Base - The anchor base (base plate) conforms to ASTM A36.

Anchor Bolts - Anchor bolts conform to ASTM F1554 Grade 55 and are provided with two hex nuts and two flat washers. Bolts have an "L" bend on one end and are galvanized a minimum of 12" on the threaded end.

Hardware - All structural fasteners are galvanized high strength carbon steel. All non-structural fasteners are galvanized or zinc-plated carbon steel or stainless steel.

Finish - Standard finishes are galvanized, prime painted or any of Valmont's V-PRO™ Protection Systems. Additional finish options available upon request.

Design Criteria - Please reference Design Criteria Specification for appropriate design conditions.

Poles - Steel

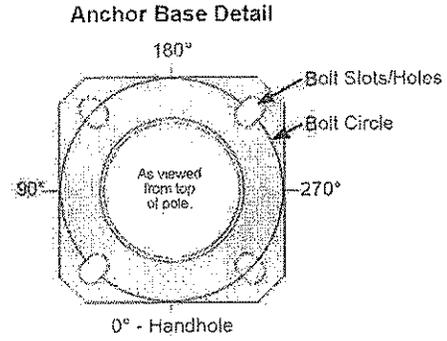
ROUND TAPERED STEEL DS210 Light Duty



Job Name: _____	Client Name: _____
Job Location - City: _____ State: _____	Created By: _____ Date: _____
Product: DS210 _____ Quote: _____	Customer Approval: _____ Date: _____

ANCHORAGE DATA

POLE	BASE PLATE				ANCHOR BOLTS			
	BASE OD (IN)	WALL THK (GA)	RECTANGLE D/A (IN)	THK (IN)	SQUARE (IN)	THK (IN)	DIAMETER X LENGTH X HOOK (IN)	PROJECTION (IN)
5.90	11	9.00	0.50	10.00	0.875	1.00 x 36.00 x 4.00	4.13	0.25
6.50	11	9.50	0.50	10.50	0.875	1.00 x 36.00 x 4.00	4.13	0.25
6.60	11	9.50	0.50	10.50	0.875	1.00 x 36.00 x 4.00	4.13	0.25
7.00	11	10.00	0.50	10.88	0.875	1.00 x 36.00 x 4.00	4.13	0.25
7.00	7	10.00	0.50	10.88	1.000	1.00 x 36.00 x 4.00	4.25	0.25
7.30	11	10.50	0.50	11.25	0.875	1.00 x 36.00 x 4.00	4.13	0.25
7.82	11	11.00	0.50	11.50	0.875	1.00 x 36.00 x 4.00	4.13	0.25
8.00	11	11.00	0.50	11.50	0.875	1.00 x 36.00 x 4.00	4.13	0.25
8.00	7	11.00	0.50	11.50	1.250	1.25 x 42.00 x 6.00	5.00	0.25
8.50	11	11.50	0.50	12.00	1.000	1.00 x 36.00 x 4.00	4.25	0.25
9.00	11	12.50	0.50	12.38	1.000	1.00 x 36.00 x 4.00	4.25	0.25
9.00	7	12.50	0.50	12.38	1.250	1.25 x 42.00 x 6.00	5.00	0.25
9.50	11	13.00	0.50	13.00	1.000	1.00 x 36.00 x 4.00	4.25	0.25
10.00	11	13.50	0.50	14.00	1.000	1.00 x 36.00 x 4.00	4.25	0.25
10.00	7	13.50	0.50	14.00	1.250	1.25 x 42.00 x 6.00	5.00	0.25



RTS / DS210

LOAD AND DIMENSIONAL DATA

NOMINAL MOUNTING HEIGHT	DESIGN INFORMATION						POLE DIMENSIONS					MODEL NUMBER
	60 MPH W/13 GUST	90 MPH W/13 GUST	100 MPH W/13 GUST	MAX EPA WEIGHT (LBS)	MAX EPA WEIGHT (LBS)	MAX EPA WEIGHT (LBS)	BASE OD (IN)	TOP OD (IN)	WALL THK (IN)	STRUCTURE WEIGHT (LBS)		
20'-0"	19.3	482	15.1	377	12.2	305	5.90	3.10	11	140	R590A200	
	24.2	605	19.3	482	15.6	390	6.50	3.70	11	160	R650A200	
25'-0"	12.5	312	9.9	247	8.0	200	5.90	2.40	11	155	R590A250	
	20.3	507	16.2	405	13.1	327	7.00	3.50	11	200	R700A250	
30'-0"	30.5	760	24.0	625	19.8	495	7.00	3.50	7	280	R700E250	
	11.7	292	9.3	232	7.5	187	6.60	2.40	11	200	R660A300	
35'-0"	18.9	473	14.9	373	12.0	300	8.00	3.80	11	265	R800A300	
	33.5	838	27.0	675	22.0	550	8.00	3.80	7	380	R800E300	
39'-0"	11.2	280	8.9	222	7.1	177	7.30	2.40	11	250	R730A350	
	18.9	472	15.1	377	12.2	305	8.50	3.60	11	315	R850A350	
45'-0"	23.2	580	18.2	455	14.5	363	9.50	4.60	11	370	R950A350	
	10.7	267	8.5	212	6.6	165	7.82	2.40	11	265	R782A389	
49'-0"	17.2	430	13.5	338	10.8	270	9.00	3.58	11	355	R900A389	
	28.5	715	23.0	575	19.0	475	9.00	3.58	7	515	R900E389	
50'-0"	17.4	435	13.5	338	10.6	265	10.00	3.70	11	450	RT00A450	
	28.5	715	23.0	575	19.0	475	10.00	3.70	7	650	RT00E450	
50'-0"	13.2	330	10.6	265	8.9	208	10.00	3.00	11	475	RT00A500	
	20.5	512	16.3	412	13.6	340	10.00	3.00	7	680	RT00E500	

DS210 Heavy Duty poles available at valmontstructures.com

Maximum EPA (Effective Projected Area) and weight values are based on top mounted luminaires and/or brackets having a centroid 2'-6" above the Nominal Mounting Height. Variations from sizes above are available upon inquiry at the factory. Satisfactory performance of poles is dependent upon the pole being properly attached to a supporting foundation of adequate design.
 2 Structure weight is a nominal value which includes the pole shaft and base plate only.

Light Duty

PRODUCT ORDERING CODES

DESIGN SERIES	MODEL NUMBER	FIXTURE MOUNTING	FINISH	COLOR	V-PRO TM PROTECTION SYSTEM	OPTIONS
DS210	R590A200 R650A200 R590A250 R700A250 R700E250 R660A300 R800A300 R800E300 R730A350 R850A350 R950A350 R782A389 R900A389 R900E389 RT00A450 RT00E450 RT00A500 RT00E500	Drill Mounting D1 = 1 Luminaire D2 = 2 @ 180° D3 = 3 @ 120° D4 = 4 @ 90° D5 = 2 @ 90° D6 = 3 @ 90° Talon Mounting P2 = 2.38" OD x 4.00" P4 = 4.0" OD x 6.00" PL = 2.40" OD Plain Top	GV = Galvanize PP = Prime Paint FP = Finish Paint GF = Galvanized + Finish Paint	-- = Galvanize -- = Prime Paint WH = White ST = Sandstone BK = Black SM = Silver Metallic SL = Silver LG = Light Gray SG = Slate Gray DT = Dark Tan MB = Medium Bronze CB = Bronze DB = Dark Bronze BN = Brown HG = Hunter Green DG = Dark Green RD = Red SC = Special Color (Contact Factory)	-- = Galvanize -- = Prime Paint V1 = V-PRO 1 Basic 1 Coat Powder V2 = V-PRO 2 2 Coat Powder or Liquid, includes epoxy primer & top coat V3 = V-PRO 3 2 Coat Powder or Liquid, includes zinc primer & top coat V4 = V-PRO 4 2 Coat Powder or Liquid, includes zinc primer & premium top coat	See Accessories at valmontstructures.com (Please Specify)

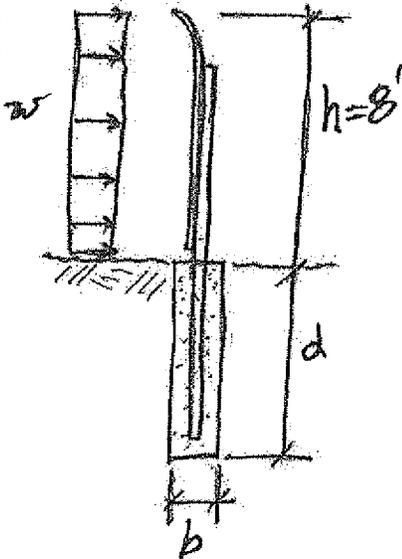
SFC7204 04/09 valmontstructures.com carries the most current spec information and supersedes these guidelines.



Consulting Engineers

2800 North Central Avenue, Suite 1010
Phoenix, AZ 85004
(602) 264-1010 Fax: (602) 285-1010

project	56 Martinez WTP	by	sheet no.
		date	24
task	Security Fence Fndn	rev	job no.
		rev	210066



wind = 20 psf open lattice
 x 50% open
 10 psf equiv. solid area

POSTS @ 8' O.C. MAX.

$$w = 8' \times 10 \text{ psf} = 80 \text{ plf}$$

$$M_{\text{base}} = \frac{w h^2}{2} = \frac{.08 \times 8^2}{2} = 2.56 \text{ k}$$

$$V_{\text{base}} = w h = .08 \times 8 = .64 \text{ k}$$

USE PLAIN CONC.

OPTIONS:	12" ϕ x 4'-0"	3.14cf	← USE
	16" ϕ x 3.75'	5.23	
	18" ϕ x 3.5'	6.2	

⇒ USE: 12" ϕ x 4'-0" embedment

see attached calc.

ROLLING GATE & PAIR SWING

18' SPAN → trib = $\frac{18' + 8'}{2} = 13'$ vs. 8'

$$w = 13' \times 10 \text{ psf} = 130 \text{ plf}$$

$$M_{\text{base}} = \frac{w h^2}{2} = \frac{.130 \times 8^2}{2} = 4.16 \text{ k}$$

$$V_{\text{base}} = w h = .130 \times 8 = 1.04 \text{ k}$$

OPTIONS: 12" ϕ x 5'

16" ϕ x 4.5'

18" ϕ x 4.25'

20" ϕ x 4'

⇒ USE: 12" ϕ x 5'-0" EMBEDMENT

- SEE ATTACHED CALC.

25

Pole Footing Embedded in Soil

File: S:\2010\03\210066 Tempe Water Treatment Security Upgrades1-Design Phase(Calculations)\enarcalc.ecb
 ENERCALC, INC. 1983-2009, Ver: 6.1.02

Project: KV7-03000128

License Owner: Jeff consulting engineers

Description: JGM - Fence Pole Foundation (w/Soil Report)

General Information

Code References: 2006 IBC 1805.7.2, 1997 UBC 1806.8.2.1

Pole Footing Shape: Circular
 Footing Diameter: 12.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive: 600.0 psf
 Max Passive: 4,000.0 psf

Controlling Values

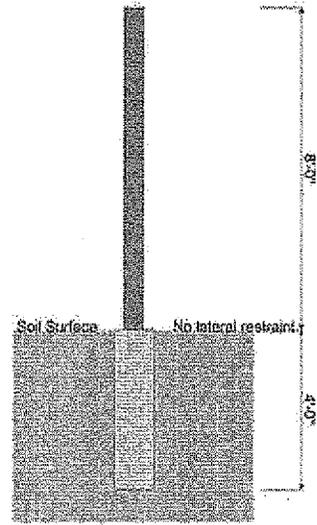
Governing Load Combination: +D+W+H
 Lateral Load: 0.640 k
 Moment: 2.560 k-ft

NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual: 790.81 psf
 Allowable: 794.47 psf

Minimum Required Depth: 4.0 ft

Footing Base Area: 0.7854 ft²
 Maximum Soil Pressure: 0.0 ksf
Assumes footing is square



Applied Loads

Lateral Concentrated Load	Lateral Distributed Load	Applied Moment	Vertical Load
D: Dead Load: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
Lr: Roof Live: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
L: Live: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
S: Snow: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
W: Wind: 0.0 k	0.080 k/ft	0.0 k-ft	0.0 k
E: Earthquake: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
H: Lateral Earth: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
Load distance above Base: 0.0 ft	TOP of Load above ground: 8.0 ft BOTTOM of Load above ground: 0.0 ft		

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth	
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)
+D+L+H	0.0	0.0	0.13	0.0	0.0
+D+Lr+H	0.0	0.0	0.13	0.0	0.0
+D+W+H	0.6	2.6	4.00	790.8	794.5
+D+0.750Lr+0.750L+0.750W+H	0.5	1.9	3.63	707.3	708.5
+D+0.750L+0.750S+0.750W+H	0.5	1.9	3.63	707.3	708.5
+0.60D+W+H	0.6	2.6	4.00	790.8	794.5

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▲

Pole Footing Embedded in Soil

File: S:\2010\jobs\210066 Tempe Water Treatment Security Upgrades\1-Design Phase\Calculations\enercalc.ecb
ENERCALC, INC. 1983-2009, Ver: 6.1.02

Job #: KV406000128

License Owner: kpmf.consulting@engineers.com

Description: JGM - Fence Gate (w/Soil Report)

General Information

Code References: 2006 IBC 1805.7.2, 1997 UBC 1806.8.2.1

Pole Footing Shape: Circular
 Footing Diameter: 12.0 in
 Calculate Min. Depth for Allowable Pressures
 No Lateral Restraint at Ground Surface
 Allow Passive: 600.0 pcf
 Max Passive: 4,000.0 psf

Controlling Values

Governing Load Combination: +D+W+H
 Lateral Load: 1.040 k
 Moment: 4.160 k-ft

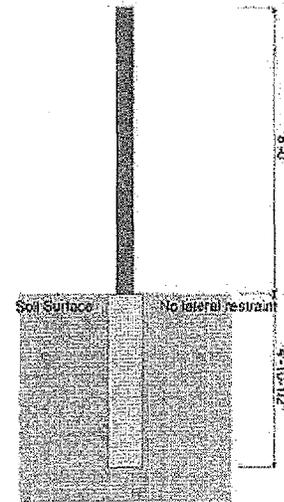
NO Ground Surface Restraint

Pressures at 1/3 Depth
 Actual: 960.76 psf
 Allowable: 964.58 psf

Minimum Required Depth	4.875 ft
------------------------	----------

Footing Base Area: 0.7854 ft²
 Maximum Soil Pressure: 0.0 ksf

Assumes footing is square



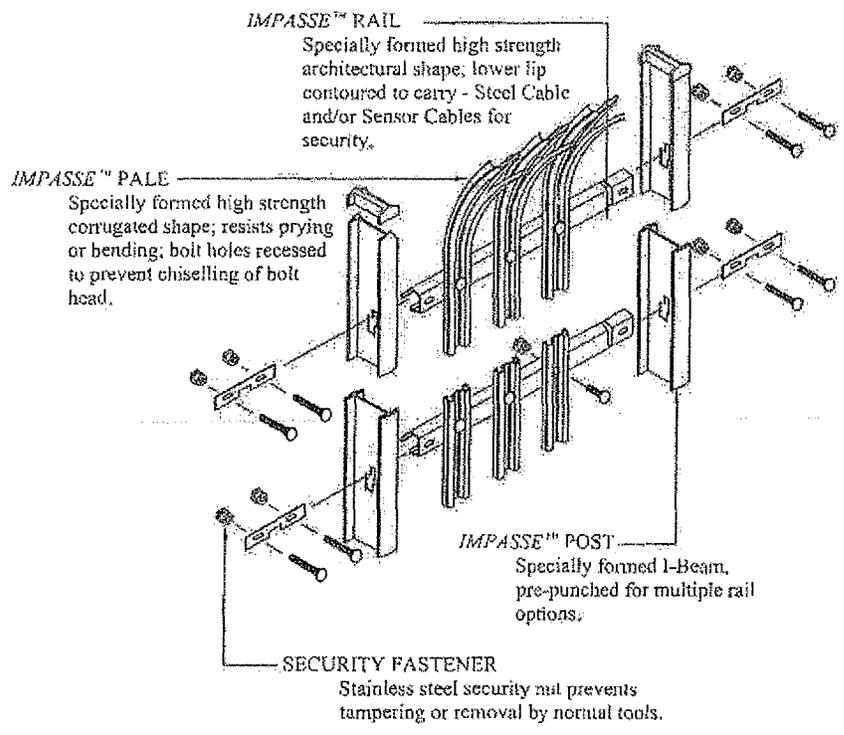
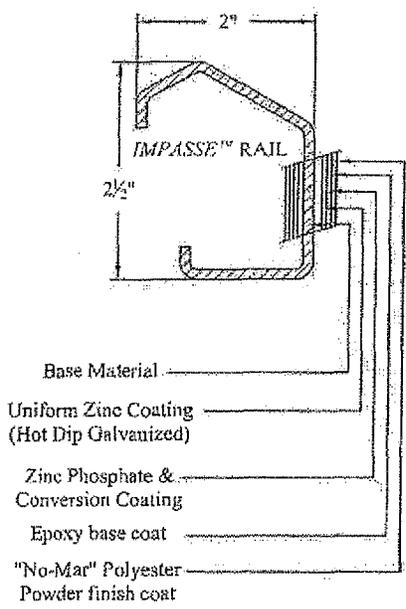
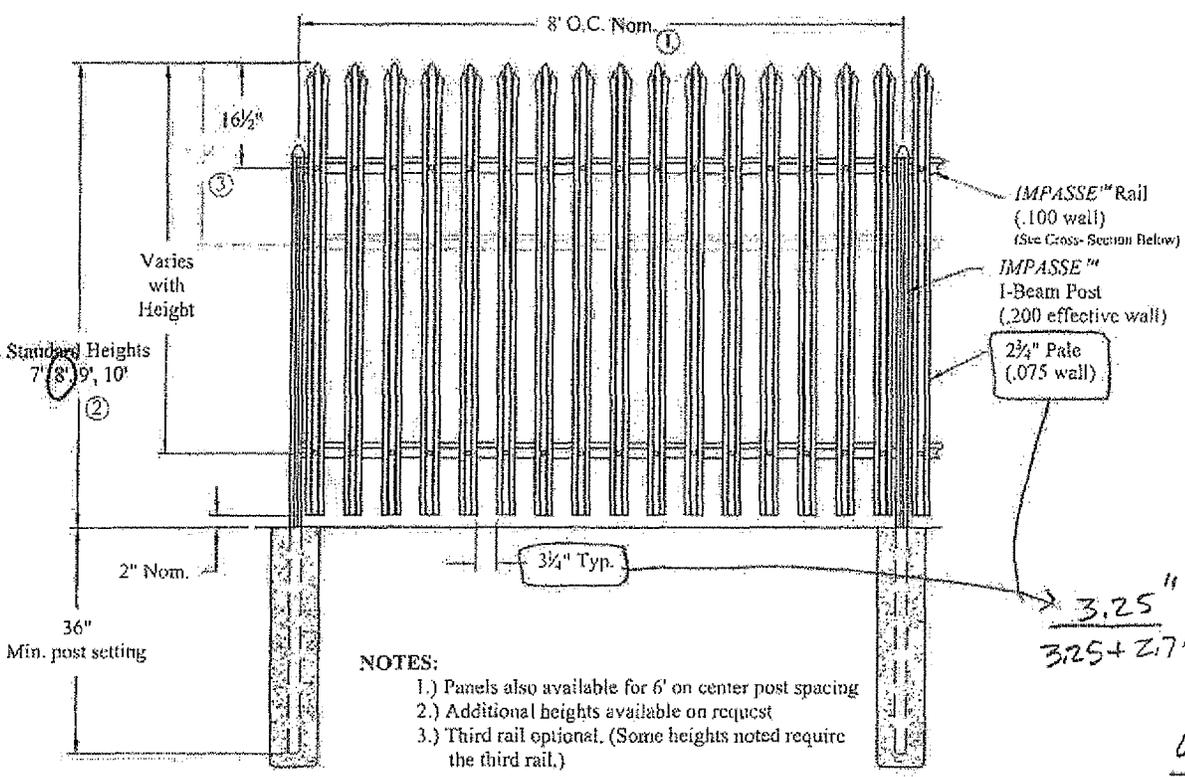
Pole Cross Section, Diameter = 1'-0"

Applied Loads

Lateral Concentrated Load	Lateral Distributed Load	Applied Moment	Vertical Load
D: Dead Load: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
Lr: Roof Live: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
L: Live: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
S: Snow: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
W: Wind: 0.0 k	0.130 k/ft	0.0 k-ft	0.0 k
E: Earthquake: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
H: Lateral Earth: 0.0 k	0.0 k/ft	0.0 k-ft	0.0 k
Load distance above Base: 0.0 ft	TOP of Load above ground: 8.0 ft		
	BOTTOM of Load above ground: 0.0 ft		

Load Combination Results

Load Combination	Forces @ Ground Surface		Required Depth - (ft)	Pressure at 1/3 Depth	
	Loads - (k)	Moments - (ft-k)		Actual - (psf)	Allow - (psf)
+D+L+H	0.0	0.0	0.13	0.0	0.0
+D+Lr+H	0.0	0.0	0.13	0.0	0.0
+D+W+H	1.0	4.2	4.88	950.8	964.6
+D+0.750Lr+0.750L+0.750W+H	0.8	3.1	4.38	857.6	858.2
+D+0.750L+0.750S+0.750W+H	0.8	3.1	4.38	857.6	858.2
+0.60D+W+H	1.0	4.2	4.88	950.8	964.6



HIGH SECURITY STEEL FENCE

IMPASSE GAUNTLET 2/3-RAIL

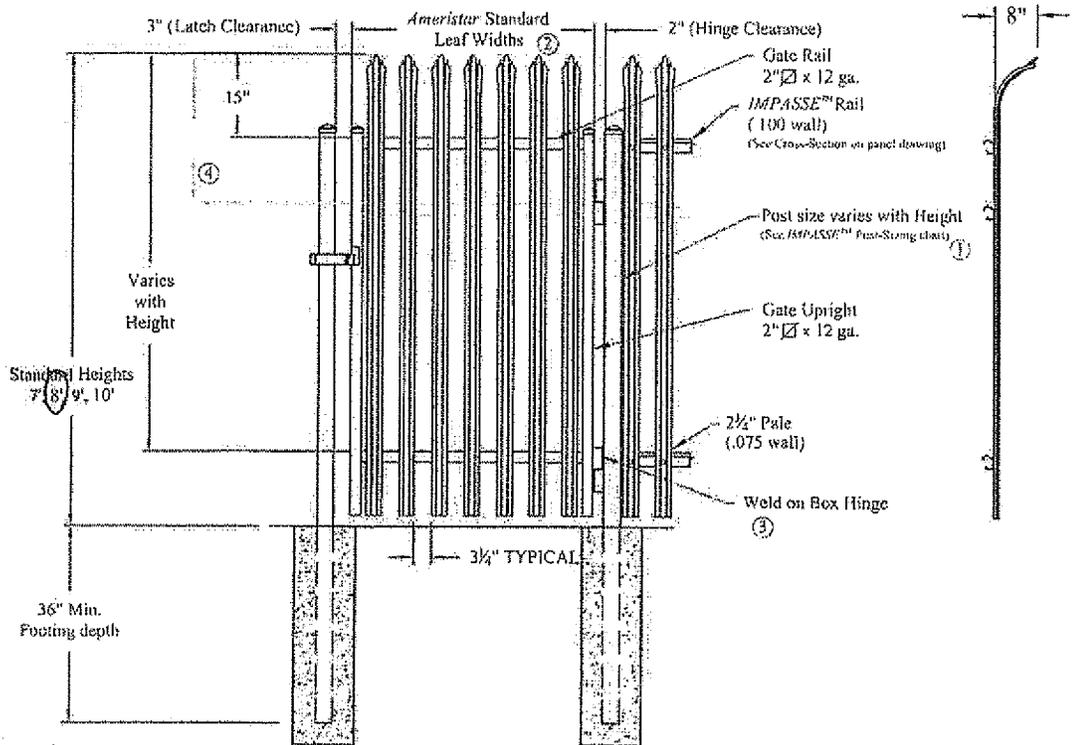
DR: RTM	SH. 1 of 1	SCALE: DO NOT SCALE
CK: MM	Date 5/15/06	REV: a



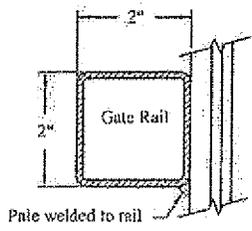
AMERISTAR®

1555 N. Mingo
 Tulsa, OK 74116
 1-888-333-3422
 www.ameristarfence.com

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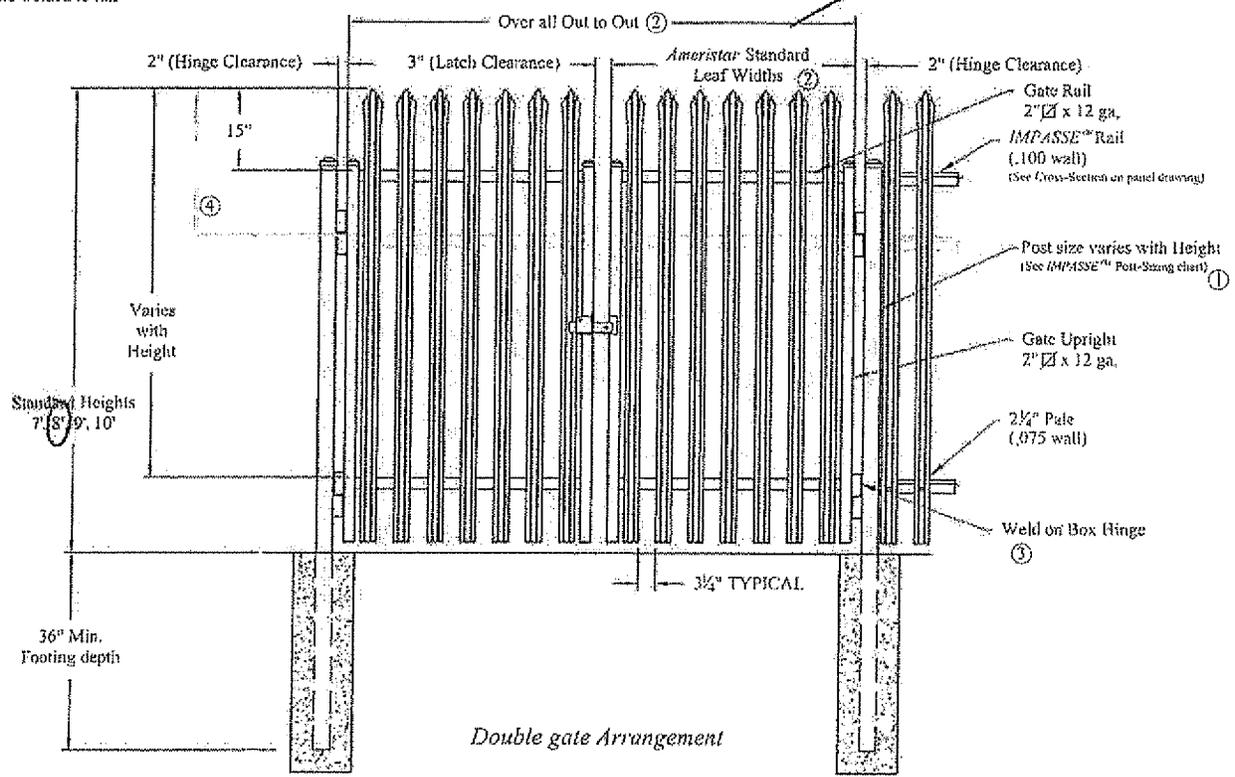
Single gate Arrangement



NOTES:

- 1.) Post size depends on fence height, weight and wind loads. See IMPASSE™ post sizing chart.
- 2.) See Ameristar gate table for standard out to outs, Custom gate openings available for special out to out/leaf widths.
- 3.) Additional styles of gate hardware are available on request. This could change the Latch & Hinge Clearance.
- 4.) Third rail optional. (Some heights noted require the third rail.)

16' MAX



Double gate Arrangement

HIGH SECURITY STEEL GATE

Title: IMPASSE GAUNTLET 2/3-RAIL SGL & DBL GATE			
DR: CI	SH. 1 of 1	SCALE: DO NOT SCALE	
CK: BS	Date 07/20/08	REV: b	

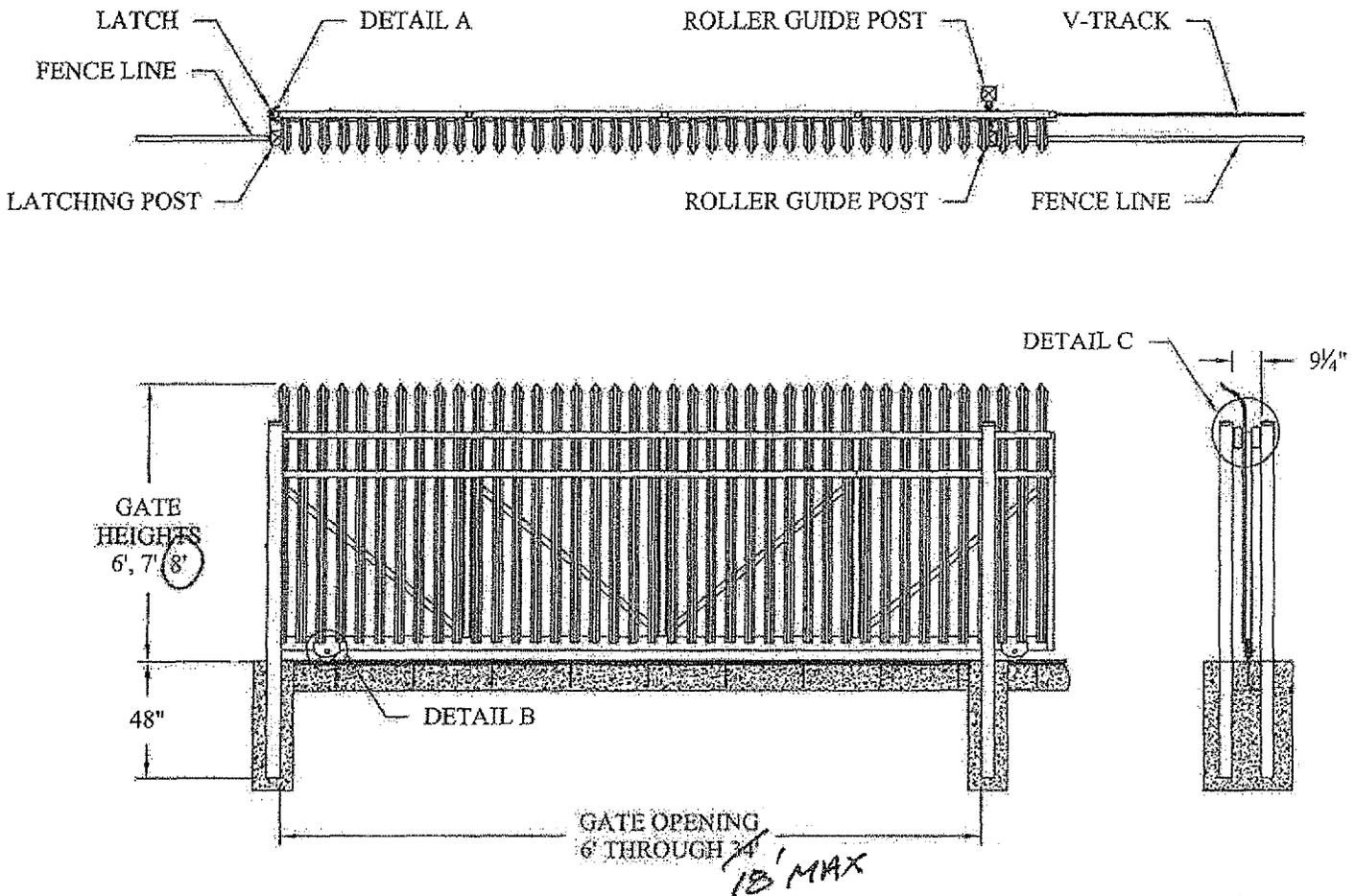


AMERISTAR®

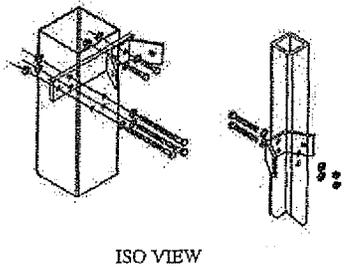
1555 N. Mingo
Tulsa, OK 74116
1-888-333-3422
www.ameristarfence.com

30180G

29

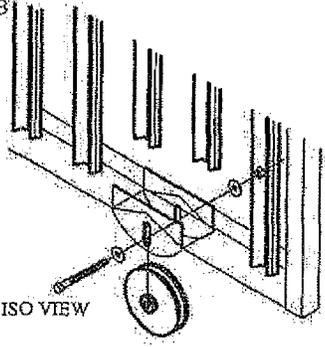


DETAIL A



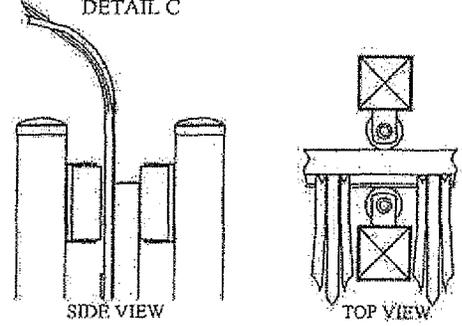
ISO VIEW

DETAIL B



ISO VIEW

DETAIL C



SIDE VIEW

TOP VIEW

PassPort IS® (Impasse Security) Roll Gate

Security Pales: Proprietary Corrugated Impasse Shape x 1/8" Thick



Top Rail(s), Uprights and Diagonals Braces: 2" Square x 11Ga.
 Bottom Rail: 2" x 4" x 11Ga. (Notched & Plated for V-track Wheels)

Roll Gate Hardware : Kit #PGKOD

Available in Profiles of 2-Rail, 3-Rail & 3-Rail w/Rings

Title: PASSPORT IS GAUNTLET INDUSTRIAL ROLL GATE

DR: CI	SH. 1 of 1	SCALE: DO NOT SCALE
CK: PB	Date 12/2/09	REV: a



AMERISTAR®

1555 N. Mingo
 Tulsa, OK 74116
 1-888-333-3422
 www.ameristarfence.com

30ISOR

project	JG Martinez WTP	by	sheet no.
	(ALTERNATIVE)	date	30
task	CCTV & LIGHT POLE FDN.	rev	job no.
	IBC 2003/2006 ASCE 7	rev	210066

CCTV AND LIGHT POLE FOUNDATION (ALT.)

LIGHTS: $12 \times 25^{\#} + 25^{\#} = 50^{\#}$ est.
 POLE: $20' \times 15 \text{ plf} = 300^{\#}$
 $\frac{50^{\#}}{2} = 0.50^{\#}/\text{LF area}$
 5" dia pipe

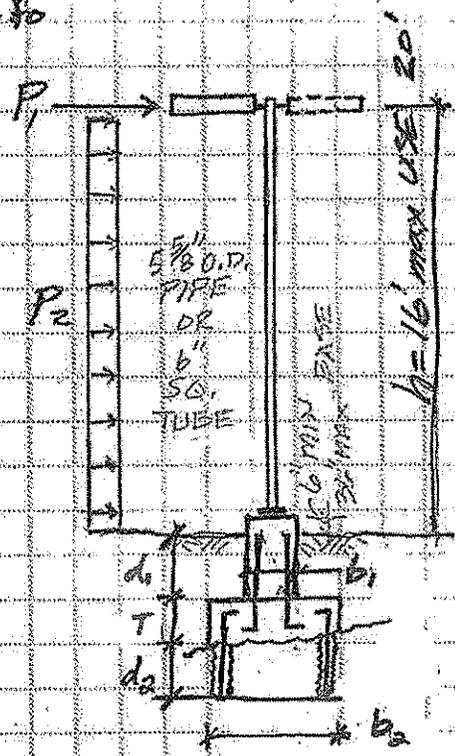
see attached product info

WIND:

$p = 18 \text{ psf}$ (see following sheets)
 $P_1 = 18 \times 2.11 = 38^{\#}$
 $P_2 = 18 \times 0.50 \times 20' = 180^{\#}$ EP = 218[#]
 9 plf controls

SEISMIC:

$V = 0.101 W_p$ (see following sheets)
 $P_1 = 0.101 \times 50^{\#} = 5^{\#}$
 $P_2 = 0.101 \times 300^{\#} = 30^{\#}$ EP = 35[#]



GEOTECH REPORT:

ALLOWABLE PASSIVE PRESS. = 350 psf/sf
 COEFF. BASE FRICTION = 0.45
 ALLOWABLE BEARING PRESS. = 1500 psf
 MOD. SUBGRADE REACTION = 200 pci.

SOILS REPORT
 R/AMM NO. G1B13
 9-13-2010

- * 1/3 INCREASE IN ALLOWABLE BEARING CAPACITY FOR WIND & SEISMIC LOADS.
- * MIN. 2'-0" FOOTING DIM. RECOMMENDED BY GEOTECH.
- * ANCHOR INTO UNDISTURBED COLLUVIAL SOIL AND/OR BRECCIA BEDROCK - SEE TABLE IN GEOTECH. REPORT P. 4.

#4 BAR - 1' EMBED	= 75 [#]	PULL-OUT	→ S = 1.2'
- 2' " "	= 575 [#]	" "	→ S = 2.5'
- 2.5' " "	= 1150 [#]	" "	→ S = 3.0'

project	by	sheet no.
task LIGHT POLE FTG	date	31
NO ANCHORS	rev	job no.
	rev	

MAT FOUNDATION:

LIGHT POLE:

- WIND CONTROLS ⇒ ANY DIRECTIONAL LOADING
 ⇒ USE SQ FOOTING.

LOADS:

$P_1 = 38^*$
 $P_2 = 9 \text{ psf}$
 $M = 38^*(20') + 9\left(\frac{20'^2}{2}\right) = 2560^* + 1800^* = \underline{2.56 \text{ K-Ft}}$
 $V = 38 + 9(20) = 218^*$

DESIGN PEDESTAL:

$M = 2.56 \text{ K-Ft}$
 $V = 218^*$
 $H = 12" \text{ MIN TO ALLOW FOR POLE ANCHORS}$
 $b = 18" \text{ DIA MIN TO ALLOW FOR } 3" \text{ CLR EDGE}$
 $w/ 9" \text{ DIA. BOLT CIR. ON BASE PL.}$
 $d = 9" \text{ EMBED W/IN } 12" \text{ MAX FTG.}$

$T_{\text{DESIGN}} = M/9" = 2.56/(9/12) = 3.41^*$

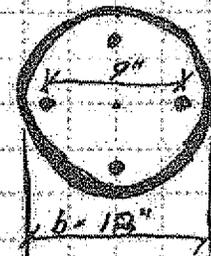
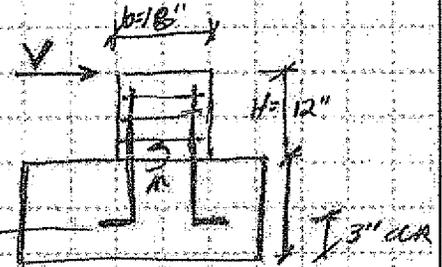
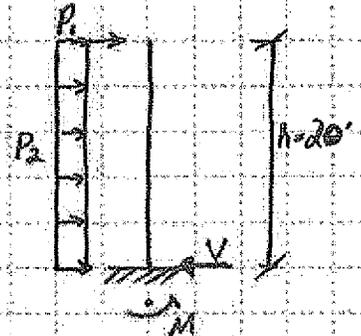
⇒ USE: (4) #4 BAR w/ STD. HOOK (MIN. EMBED = 8")
 IN 3000 PSI CONC.

⇒ USE: 1'-6" DIA X 1'-0" DEEP CONC
 PEDESTAL (3000 PSI MIN)
 w/ (4) #4 DOUBLE BARS STD. HOOK
 AND #3 TIES @ 6" O.C. MAX.

DESIGN FTG w/o ANCHORS:

$M = 2.56 \text{ K-Ft (WIND)}$
 $Q = 1500 \text{ psf (x1.33 WIND)}$
 $f'_c = 3000 \text{ psi}$

⇒ USE: 12" THICK X 4'-6" SQ FTG
 w/ (4) #4 E.W. T1B
 - SEE ATTACHED CALC.



General Footing Design

File: S:\2010\jobs\210066 Tempe Water Treatment Security Upgradest1-Design Phase\Calculations\enercalc.ec6
ENERCALC, INC. 1983-2009, Ver: 6.1.02

Proj #: KW-06000123

License Owner: kpf consulting engineers

az

Description: JGM - Mat FDN - Light Pole (no anchors)

General Information

Calculations per IBC 2006, CBC 2007, ACI 318-05

Material Properties

f_c : Concrete 28 day strength	=	3.0	ksi
f_y : Rebar Yield	=	60.0	ksi
E_c : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
ϕ Values Flexure	=	0.90	
Shear	=	0.750	

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	350.0	pcf
Soil/Concrete Friction Coeff.	=	0.450	

Analysis Settings

Min Steel % Bending Reinf.	=	0.00140	
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.50	:1
Min. Sliding Safety Factor	=	1.50	:1
AutoCalc Footing Weight as DL	:	Yes	
AutoCalc Pedestal Weight as DL	:	Yes	

Increases based on footing Depth

Reference Depth below Surface	=		ft
Allow. Pressure Increase per foot of depth when base footing is below	=		ksf
	=		ft

Increases based on footing Width

Allow. Pressure Increase per foot of width when footing is wider than	=		ksf
	=		ft

Dimensions

Width along X-X Axis	=	4.50	ft
Length along Z-Z Axis	=	4.50	ft
Footing Thickness	=	12.0	in

*12" Thick
4.5' sq*

Load location offset from footing center...

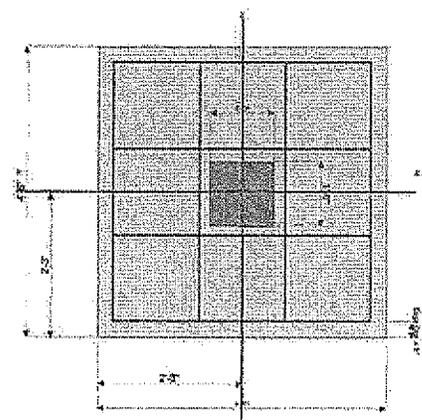
ex : Along X-X Axis	=	0	in
ez : Along Z-Z Axis	=	0	in

Pedestal dimensions...

px : Along X-X Axis	=	12.0	in
pz : Along Z-Z Axis	=	12.0	in
Height	=	12.0	in

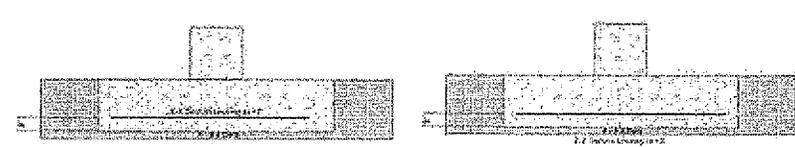
Rebar Centerline to Edge of Concrete..

at Bottom of footing	=	3.0	in
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Reinforcing

Bars along X-X Axis	=	4.0	
Number of Bars	=	# 4	
Reinforcing Bar Size	=	# 4	
Bars along Z-Z Axis	=	4.0	
Number of Bars	=	# 4	
Reinforcing Bar Size	=	# 4	



Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	=	n/a	
# Bars required within zone	=	n/a	
# Bars required on each side of zone	=	n/a	

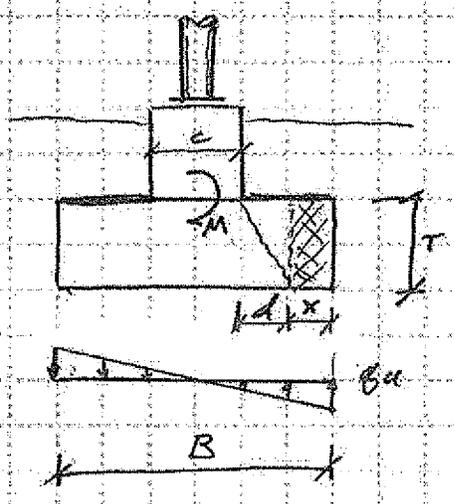
Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.350					k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				2.560		k-ft
V-x	=				0.2180		k
V-z	=						k

DESIGN FTG. w/ ANCHORS:

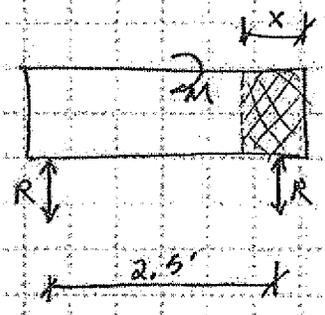
$M = 2.56 \text{ k-ft}$ (WIND)
 $Q = 1500 \text{ psf} \times 1.33 = 1995 \text{ psf}$ (SOIL WIND)
 $B = 3' \text{ SQ}$, $T = 1'$, $C = 1'$
 $f'_c = 3000 \text{ psi}$

$\phi M_{max} = \phi_u = (1.6) \frac{E M}{BL} = \frac{(1.6)(2.56)}{3' \times 1'} = 2720 \text{ psf/ft WIDTH}$
 $x = \frac{B}{2} - \frac{c}{2} - d = 18" - 6" - 7.5" = 4.5"$
 $V_u = \phi_u \times B = 2720 \left(\frac{4.5}{12}\right) (3) = 3060$
 $d = \frac{V_u}{\phi A_s f'_c b} = \frac{3060}{(0.75)(0.75)(3000)(12)} = \frac{3060}{9825} = 3"$
3" < Assumed 7.5" \Rightarrow OK FOR BM SHEAR



BEARING / RECTIONS:

$M = 2.56 \text{ k-ft}$
 ANCHORS AT 2.5'
 $R = 2.56 / 2.5 = 1.024 \text{ k} = 1024 \text{ #}$



CHECK BEARING:

$x = 4.5/12 = 0.375'$
 $Q_u = 1995 \text{ psf} \times 0.375' \times 3' = 2244 \text{ #} > 1024 \text{ #} \Rightarrow$ OK BRG

UPLIFT / OVERTURNING:

#4 BAR ANCHOR, 2' EMBED, $S = 2.5'$ $T_{ANCHOR} = 575 \text{ # EA.}$
 $\Rightarrow (2) 575 = 1150 \text{ #} > 1024 \text{ #} \Rightarrow$ OK UPLIFT - (4) #4 @ 2.5' ANCHORS @ DEEP

REINF:

$M_u = \phi_u \times B \times x^2 / 2 = 2.72 (3) (1')^2 / 2 = 4.08 \text{ k-ft}$
 $\phi M_n = (0.9) (3' \times 12") (7.5") (0.003) (60) [1 - 0.59 (0.003) (\frac{60}{3})] = 316.4 = 26.3 \text{ k-ft} > 4.08 \Rightarrow$ OK
 $A_s = \phi_u b d = (0.003) (3' \times 12") (7.5") = 0.81 \text{ m}^2 \quad \left\{ (4) \#4 = 0.77 \text{ m}^2 \Rightarrow \text{OK} \right.$
 $A_{s,min} = 0.0018 b h = 0.0018 (3' \times 12") (12") = 0.78 \text{ m}^2$

\Rightarrow USE: 12" x 3'-0" SQ. FTG w/ (4) #4 ED. TB. w/ #4 x 2'-0" EMBED ANCHOR EA. CORNER

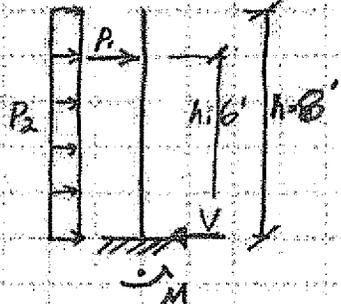
MAT FOUNDATION:

FENCE:

- WIND CONTROLS ⇒ ONE DIRECTIONAL LOADING
- FENCE * 50% OPEN (LATTICE)
- POSTS @ 8'-0" O.C. MAX.

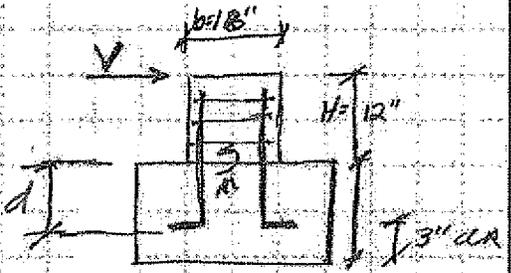
LOADS:

$P_1 = 250 \# @ 6'$ (LIVE LOAD - 06 IBC/MANDRILLS)
 $P_2 = 20(50\%)(8') = 80 \text{ psf}$ (WIND)
 $M_{D1} = 250 \# \times 6' = 1.5 \text{ k-ft}$
 $M_{D2} = w h^2 / 2 = 80(8)^2 / 2 = 2.56 \text{ k-ft} \leftarrow \text{GOVERNS}$
 $V_{P1} = 250 \#, V_{P2} = w h = 640 \#$



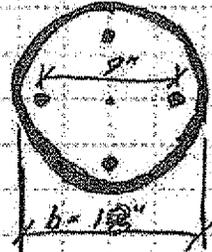
DESIGN PEDESTAL:

$M = 2.56 \text{ k-ft}$
 $V = 218 \#$
 $H = 12" \text{ MIN TO ALLOW FOR POLE ANCHORS}$
 $b = 18" \text{ DIA MIN TO ALLOW FOR } 3" \text{ CUR EDGE}$
 $w/ 9" \text{ DIA BOLT CIR. ON BASE PL}$
 $d = 9" \text{ EMBED W/IN } 12" \text{ MAX FTG.}$



$T_{req'd} = M / 9" = 2.56 / (9/12) = 3.41 \text{ K}$

⇒ USE: (4) #4 BAR w/ STD. HOOK (MIN. EMBED = 8")
 IN 3000 PSI CONC.



⇒ USE: 1'-0" DIA X 1'-0" DEEP CONC. PEDESTAL (3000 PSI MIN)
 w/ (4) #4 DOUBLE BARS STD. HOOK AND #3 TIES @ 6" O.C. MAX.

DESIGN FTG w/o ANCHORS:

$M = 2.56 \text{ k-ft}$ (WIND)
 $Q = 1500 \text{ psf}$ ($\times 1.33$ WIND)
 $f'_c = 3000 \text{ psi}$

⇒ USE: 12" THICK X 4'-6" SQ FTG
 w/ (4) #4 E.W. T+ B
 - SEE ATTACHED CALC.

Description : JGM - Mat FDN - Fence (no anchors)

General Information

Calculations per IBC 2006, CBC 2007, ACI 318-05

Material Properties

fc : Concrete 28 day strength	=	3.0	ksi
Fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
Φ Values Flexure	=	0.90	
Shear	=	0.750	

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	350.0	pcf
Soil/Concrete Friction Coeff.	=	0.450	

Analysis Settings

Min Steel % Bending Reinf.	=	0.00140	
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.50	:1
Min. Sliding Safety Factor	=	1.50	:1
AutoCalc Footing Weight as DL	=	Yes	
AutoCalc Pedestal Weight as DL	=	Yes	

Increases based on footing Depth

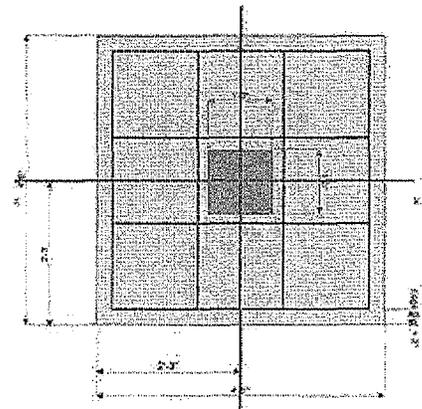
Reference Depth below Surface	=	0.0	ft
Allow. Pressure Increase per foot of depth when base footing is below	=	0.0	ksf
	=	0.0	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width when footing is wider than	=	0.0	ksf
	=	0.0	ft

Dimensions

Width along X-X Axis	=	4.50	ft
Length along Z-Z Axis	=	4.50	ft
Footing Thickness	=	12.0	in
Load location offset from footing center...			
ex : Along X-X Axis	=	0	in
ez : Along Z-Z Axis	=	0	in
Pedestal dimensions...			
px : Along X-X Axis	=	12.0	in
pz : Along Z-Z Axis	=	12.0	in
Height	=	12.0	in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0	in



Reinforcing

Bars along X-X Axis			
Number of Bars	=	4.0	
Reinforcing Bar Size	=	# 4	
Bars along Z-Z Axis			
Number of Bars	=	4.0	
Reinforcing Bar Size	=	# 4	



Bandwidth Distribution Check (ACI 15.4.4.2)

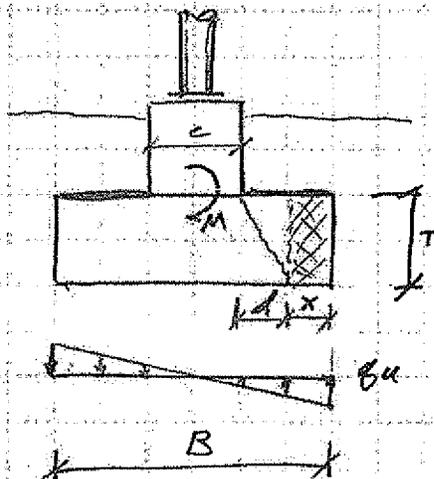
Direction Requiring Closer Separation	=	n/a	
# Bars required within zone	=	n/a	
# Bars required on each side of zone	=	n/a	

Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.350	0.0	0.0	0.0	0.0	0.0 k
OB : Overburden	=	0.0	0.0	0.0	0.0	0.0	0.0 ksf
M-xx	=	0.0	0.0	0.0	0.0	0.0	0.0 k-ft
M-zz	=	0.0	0.0	0.0	2.560	0.0	0.0 k-ft
V-x	=	0.0	0.0	0.0	0.0	0.0	0.0 k
V-z	=	0.0	0.0	0.0	0.2180	0.0	0.0 k

DESIGN FTG. w/ ANCHORS:

$M = 2.56 \text{ k.ft}$ (WIND)
 $Q = 1500 \text{ psf} \times 1.33 = 1995 \text{ psf}$ (SOIL WIND)
 $B = 3' \text{ SQ}, T = 1', c = 1'$
 $f'_c = 3000 \text{ psi}$



$\pm q_{max} = q_u = (1.6) \frac{BM}{BL} = \frac{(1.6)(2.56)}{3 \times 1} = 1.2720 \text{ psf/ft width}$

$x = \frac{B}{2} - \frac{c}{2} - d = 18" - 6" - 7.5" = 4.5"$

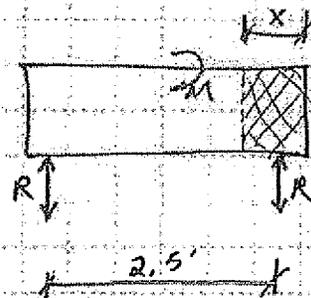
$V_u = q_u \times B = 2720 \left(\frac{4.5}{12}\right) (3) = 3060$

$d = \frac{V_u}{\phi R V_{fc} b} = \frac{3060}{(0.75)(\phi) \sqrt{3000} (12)} = \frac{3060}{988} = 3"$

3" < Assumed 7.5 \Rightarrow OK FOR BM SHEAR (MIN 1' WIDTH)

BEARING / BREATHERS

$M = 2.56 \text{ k.ft}$
 ANCHORS AT 2.5'
 $R = 2.56 / 2.5 = 1.024 \text{ k} = 1024 \text{ \#}$



CHECK BEARING:

$x = 4.5 / 12 = 0.375'$

$Q_u = 1995 \text{ psf} \times 0.375' \times W = 1024 \text{ \#} \Rightarrow W = 1.37'$

$\Rightarrow Q_u = 1995 \times 0.375' \times 1.5' = 1122 \text{ \#} > 1024 \text{ \#} \Rightarrow$ BRG OK

UPLIFT / OVERTURNING:

#4 BAR ANCHOR, 2' EMBED, $S = 2.5'$ $T_{ANCHOR} = 575 \text{ \# EA.}$

$\Rightarrow (2) 575 = 1150 \text{ \#} > 1024 \text{ \#} \Rightarrow$ OK UPLIFT - (4) #4 @ 2.5' ANCHORS 2' DEEP

REINFC:

$M_u = q_u b x^2 / 2 = 2.72 (3) (1)^2 / 2 = 4.08 \text{ k.ft}$

$\phi M_n = (0.9) (3' \times 12") (7.5)^2 (0.003) (66) [1 - 0.59 (0.003) (\frac{66}{3})] = 316.4 = 26.3 \text{ k.ft} > 4.08$

$A_s = \frac{M_u}{\phi f_y b d} = \frac{4.08}{(0.9) (3' \times 12") (7.5)} = 0.81 \text{ in}^2$ } (4) #4 = 0.77 in² \Rightarrow OK

$A_{s,min} = 0.0018 b h = 0.0018 (3' \times 12") (12) = 0.78 \text{ in}^2$ }

\Rightarrow USE: 12" x 3'-0" SQ FTG w/ (4) #4 EV. TB. w/ #4 x 2'-0" EMBED ANCHOR EA. CORNER



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project

by

sheet no.

39

date

task

SECURITY GATE FTG

rev

job no.

rev

MAT FOUNDATION:

* GATE = 18' SPAN \Rightarrow TRID = $(18'+8')/2 = 13'$

$W = (10 \text{ psf}) (13') = 130 \text{ plf}$

$M = 130 (8')^2 / 2 = 4.16 \text{ K.ft}$

$V = 130 (8') = 1.04 \text{ K}$

DESIGN:

□ FTG w/o ANCHORS:

USE: 12" THICK X 6'-0" SQ FTG.

w/ (5) #4 ELD T&B.

- SEE ATTACHED CALC

□ FTG w/ ANCHORS:

TRY 3' SQ: $R = 4.16 / 2.5 = 1.664 = \underline{1664} \#$

$Q_u = 1175 \times 0.375 \times 3' = 2244 > 1664 \Rightarrow \underline{OK}$

ANCHOR: (2) #4 x 2' @ 2.5' = $575 \times 2 = 1150 < 1664 \Rightarrow \text{NG}$

\Rightarrow (2) #4 x 2'-6" @ 3' o.c. = $1150 \times 2 = 2300 > 1664 \Rightarrow \underline{OK}$

USE: 12" THICK X 3'-6" SQ FTG w/

(4) #4 ELD T&B w/

#4 x 2'-6" EMBED ANCHOR EA CORNER.

General Footing Design

File: S:\2010\jobs\210066 Tempe Water Treatment Security Upgrades\1-Design Phase\Calculations\enercalc.ecd
 ENERCALC, INC. 1983-2008, Ver: 6.1.02

Proj. #: KW-06000128

License Owner: knif consulting engineers

az

Description: JGM - Met FDN - Gate (no anchors)

General Information

Calculations per IBC 2006, CBC 2007, ACI 318-05

Material Properties

f_c : Concrete 28 day strength	=	3.0	ksi
F_y : Rebar Yield	=	60.0	ksi
E_c : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
ϕ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	0.00140	
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.50	:1
Min. Sliding Safety Factor	=	1.50	:1
AutoCalc Footing Weight as DL	:	Yes	
AutoCalc Pedestal Weight as DL	:	Yes	

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	350.0	pcf
Soil/Concrete Friction Coeff.	=	0.450	

Increases based on footing Depth

Reference Depth below Surface	=	0.0	ft
Allow. Pressure Increase per foot of depth when base footing is below	=	0.0	ksf
	=	0.0	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width when footing is wider than	=	0.0	ksf
	=	0.0	ft

Dimensions

Width along X-X Axis	=	6	ft
Length along Z-Z Axis	=	6	ft
Footing Thickness	=	14.0	in

Load location offset from footing center...

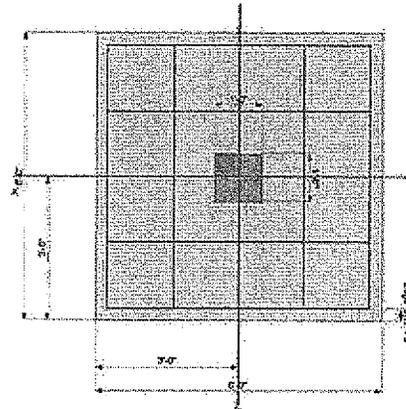
e_x : Along X-X Axis	=	0	in
e_z : Along Z-Z Axis	=	0	in

Pedestal dimensions...

p_x : Along X-X Axis	=	12.0	in
p_z : Along Z-Z Axis	=	12.0	in
Height	=	12.0	in

Rebar Centerline to Edge of Concrete..

at Bottom of footing	=	3.0	in
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Reinforcing

Bars along X-X Axis	=	5.0	
Number of Bars	=	# 4	
Reinforcing Bar Size	=	# 4	

Bars along Z-Z Axis	=	5.0	
Number of Bars	=	# 4	
Reinforcing Bar Size	=	# 4	

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	=	n/a	
# Bars required within zone	=	n/a	
# Bars required on each side of zone	=	n/a	



Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.0	0.0	0.0	0.0	0.0	0.0 k
OB : Overburden	=	0.0	0.0	0.0	0.0	0.0	0.0 ksf
M-xx	=	0.0	0.0	0.0	0.0	0.0	0.0 k-ft
M-zz	=	0.0	0.0	0.0	0.0	4.160	0.0 k-ft
V-x	=	0.0	0.0	0.0	0.0	1.040	0.0 k
V-z	=	0.0	0.0	0.0	0.0	0.0	0.0 k

