Project Manual

For

New Portable Classroom Building

VOLUME 1
Specifications

for the

Camarillo Academy of Progressive Education
777 Aileen Street, Camarillo, CA 93010

September 30, 2019

PBK Project No.: 19172

LICENSED ARCHITECT
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06-30-2021
RENEWAL DATE
STATE OF CALIFORNIA

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SECTION 01 10 00 SUMMARY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. Section includes requirements including but not limited to:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification:
1. Project Location: **Camarillo Academy of Progressive Education**
777 Aileen Street
Camarillo, CA 93010

B. Owner: Pleasant Valley School District
1. Owner's Representative: Doreen Learned

C. Architect: **PBK Architects**, 2751 Park View Court, Suite 251, Oxnard, CA 93036

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

Construction of one (1) 40'x48' 2-Classrooom portable building on non-permanent foundations.

Upgrades to the (E) path of travel, replacement of (E) FCI (Fire Control Instruments) main fire alarm panel and installation of a new annunciator system with voice evacuation handset will be required to support the new portable building.

B. Type of Contract: Project will be constructed under a single, Prime Contract for General Construction. The Contractor shall hold a "B" or "C-43" Contractor License in the state of California.

1.5 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

A. The Owner reserves the right to let separate contract for work outside of the scope of this Contract. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate

contracts.

1.6 ACCESS TO SITE

A. Use of Site: Limit use of Project site to Work in areas and areas within the Contract limits indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
   1. Limits: The drawings indicate the limits of the construction operations.
   2. Driveways, Walkways, and Entrances: Keep driveways. parking areas, student drop off and pick up points, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the students, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

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

1.7 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On Site Work Hours: Limit Work on the existing building to normal working hours, Monday through Friday, unless otherwise indicated. Coordinate with Owner when it is necessary to extend working hours or Work on weekends.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
   2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two weeks in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

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

situations. These conventions are as follows:

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

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

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. The Owner has a critical need for the work to begin upon Notice to Proceed and shall be Substantially Complete by August 10, 2019**. There will be No Extensions of Time due to weather.**

END OF SECTION 01 10 00

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
      a. General coordination procedures.
      b. Pre-install meetings.

B. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. Requests for Information (RFI's) will not be allowed from the Contractor. The Contractor shall arrange the necessary meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation.

1.3 SUBMITTALS

A. Subcontract List:
   1. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
      a. Name, address, and telephone number of entity performing subcontract or supplying products.
      b. Number and title of related Specification Section(s) covered by subcontract.
      c. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names:
   1. Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project Site. Identify individuals and the duties and responsibilities; list address, telephone numbers, (Home, office, and cellular) and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project:
      a. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

A. Coordinate construction operations to ensure efficient and orderly installation of each part 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 performance and

accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

1.5 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated:
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the project.

B. Kick-off and Preconstruction Conference:
1. Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect:
a. Conduct the conference to review responsibilities and personnel assignments.
b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
c. Agenda: Discuss items of significance that affect progress.
d. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
e. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

C. Progress Meetings:
1. Conduct progress meetings at weekly intervals:
a. Coordinate dates of meetings with preparation of payment requests.
b. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
c. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project:
1) Contractor's Construction Schedule: Review progress since the last 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 the Contract Time.
d. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information:

1) Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
2) One (1) week look-ahead schedules.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated and paid by the District (Or refer to Section 01 45 23). These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements:
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

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

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

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

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

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

F. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector:
   1. Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations:
      a. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, *experienced* means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

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

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Shop Drawings:
   1. Submit plans, sections, and elevations, indicating materials and size of mockup construction:
      a. Indicate manufacturer and model number of individual components.

B. Schedule of Tests and Inspections:
   1. Prepare in tabular form and include the following:
      a. Specification Section number and title.
      b. Entity responsible for performing tests and inspections.
      c. Description of test and inspection.
      d. Identification of applicable standards.
      e. Identification of test and inspection methods.
      f. Number of tests and inspections required.
      g. Time schedule or time span for tests and inspections.
      h. Requirements for obtaining samples.
      i. Unique characteristics of each quality control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports:
   1. Prepare and submit certified written reports specified. Include the following:
      a. Date of issue.
      b. Project title and number.

c. Name, address, and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making tests and inspections.
f. Description of the Work and test and inspection method.
g. Identification of product and Specification Section.
h. Complete test or inspection data.
i. Test and inspection results and an interpretation of test results.
j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
k. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports:
1. Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
a. Name, address, and telephone number of technical representative making report.
b. Statement on condition of substrates and their acceptability for installation of product.
c. Statement that products at site comply with requirements.
d. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
e. Results of operational and other tests and a statement of whether observed performance complies with requirements.
f. Statement whether conditions, products, and installation will affect warranty.
g. Other required items indicated in individual Specification Sections.

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

D. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.7 QUALITY ASSURANCE

A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.

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

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

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

indicated:
a. Requirements of authorities having jurisdiction supersede requirements for specialists.

F. Testing Agency Qualifications:
1. An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities:
a. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
b. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products.

H. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products.

I. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.8 QUALITY CONTROL

A. Owner Responsibilities:
1. Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services:
a. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
b. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities:
1. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not:
a. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
b. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
c. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
d. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
e. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
f. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including

service connections. Report results in writing as specified in Section 01 33 00.

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities:
   1. Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:
      a. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
      b. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
      c. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
      d. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
      e. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
      f. Do not perform any duties of Contractor.

G. Associated Services:
   1. 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:
      a. Access to the Work.
      b. Incidental labor and facilities necessary to facilitate tests and inspections.
      c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
      d. Facilities for storage and field curing of test samples.
      e. Delivery of samples to testing agencies.
      f. Preliminary design mix proposed for use for material mixes that require control by testing agency.
      g. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination:
   1. Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting:
      a. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections:
   1. Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule.

PART 2 PRODUCTS (Not Used)

PART 2 EXECUTION

2.1 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29.

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 01 40 00

SECTION 01 42 00 REFERENCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments, associated with regulations, codes, and standards.

B. “Regulations” is defined to include laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the Work regardless of whether they are lawfully imposed by governing authority or not.

C. Governing Regulations:
   1. Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations:
      a. The Division of the State Architect (DSA), State of California, provide design and construction oversight for this project and as such is subject to the rules and regulations.

1.3 DEFINITIONS

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

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

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

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

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

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

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

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

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

J. “Testing Agencies”: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and , if required, to interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards the Contractor must keep available at the project site for reference.

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

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the Work to be provided or performed. Unless otherwise indicated, the actual Work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to the Architect/Engineer for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction or other entity applicable to the context of the text provision:
   1. AABC - Associated Air Balance Council; www.aabc.com.
   2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
   3. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
   4. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
   5. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
   6. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
   7. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
   8. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
   9. AGA - American Gas Association; www.aga.org.

10. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
11. AI - Asphalt Institute; www.asphaltinstitute.org.
12. AIA - American Institute of Architects (The); www.aia.org.
13. AISC - American Institute of Steel Construction; www.aisc.org.
14. AISI - American Iron and Steel Institute; www.steel.org.
15. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
16. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
17. ANSI - American National Standards Institute; www.ansi.org.
18. APA - APA - The Engineered Wood Association; www.apawood.org.
19. APA - Architectural Precast Association; www.archprecast.org.
20. API - American Petroleum Institute; www.api.org.
21. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
22. ARI - American Refrigeration Institute; (See AHRI).
23. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
24. ASCE - American Society of Civil Engineers; www.asce.org.
25. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
26. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
27. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
28. ASSE - American Society of Safety Engineers (The); www.asse.org.
29. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
30. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
31. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
32. AWI - Architectural Woodwork Institute; www.awinet.org.
33. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
34. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
35. AWS - American Welding Society; www.aws.org.
36. AWWA - American Water Works Association; www.awwa.org.
37. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
38. BIA - Brick Industry Association (The); www.gobrick.com.
39. BICSI - BICSI, Inc.; www.bicsi.org.
40. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
41. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
42. CEA - Consumer Electronics Association; www.ce.org.
43. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
44. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
45. CGA - Compressed Gas Association; www.cganet.com.
46. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
47. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
48. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
49. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
50. CPA - Composite Panel Association; www.pbmdf.com.
51. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
52. CRRC - Cool Roof Rating Council; www.coolroofs.org.
53. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.

54. CSA - Canadian Standards Association; www.csa.ca.
55. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
56. CSI - Construction Specifications Institute (The); www.csinet.org.
57. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
58. CWC - Composite Wood Council; (See CPA).
59. DSA – Division of the State Architect. State of California.
60. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
61. DHI - Door and Hardware Institute; www.dhi.org.
62. ECA - Electronic Components Association; www.ec-central.org.
63. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
64. EIA - Electronic Industries Alliance; (See TIA).
65. EIMA - EIFS Industry Members Association; www.eima.com.
66. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
67. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
68. ESTA - Entertainment Services and Technology Association; (See PLASA).
69. EVO - Efficiency Valuation Organization; www.evo-world.org.
70. FM Approvals - FM Approvals LLC; www.fmglobal.com.
71. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
72. FSC - Forest Stewardship Council U.S.; www.fscus.org.
73. GA - Gypsum Association; www.gypsum.org.
74. GANA - Glass Association of North America; www.glasswebsite.com.
75. GS - Green Seal; www.greenseal.org.
76. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
77. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
78. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
79. ICBO - International Conference of Building Officials; (See ICC).
80. ICC - International Code Council; www.iccsafe.org.
81. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
82. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
83. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
84. IEC - International Electrotechnical Commission; www.iec.ch.
85. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
86. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
87. IESNA - Illuminating Engineering Society of North America; (See IES).
88. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
89. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
90. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
91. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
92. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
93. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
94. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
95. ISO - International Organization for Standardization; www.iso.org.
96. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
97. ITU - International Telecommunication Union; www.itu.int/home.
98. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
99. LMA - Laminating Materials Association; (See CPA).
100. LPI - Lightning Protection Institute; www.lightning.org.
101. MBMA - Metal Building Manufacturers Association; www.mbma.com.

102. MCA - Metal Construction Association; www.metalconstruction.org.
103. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
104. MHIA - Material Handling Industry of America; www.mhia.org.
105. MIA - Marble Institute of America; www.marble-institute.com.
106. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
107. MPI - Master Painters Institute; www.paintinfo.com.
108. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
109. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
110. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
111. NADCA - National Air Duct Cleaners Association; www.nadca.com.
112. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
113. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
114. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
115. NCMA - National Concrete Masonry Association; www.ncma.org.
116. NEBB - National Environmental Balancing Bureau; www.nebb.org.
117. NECA - National Electrical Contractors Association; www.necanet.org.
118. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
119. NEMA - National Electrical Manufacturers Association; www.nema.org.
120. NETA - InterNational Electrical Testing Association; www.netaworld.org.
121. NFHS - National Federation of State High School Associations; www.nfhs.org.
122. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
123. NFPA - NFPA International; (See NFPA).
124. NFRC - National Fenestration Rating Council; www.nfrc.org.
125. NHLA - National Hardwood Lumber Association; www.nhla.com.
126. NLGA - National Lumber Grades Authority; www.nlga.org.
127. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
128. NRCA - National Roofing Contractors Association; www.nrca.net.
129. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
130. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
131. NSPE - National Society of Professional Engineers; www.nspe.org.
132. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
133. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
134. NWFA - National Wood Flooring Association; www.nwfa.org.
135. PDI - Plumbing & Drainage Institute; www.pdionline.org.
136. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
137. RFCI - Resilient Floor Covering Institute; www.rfci.com.
138. RIS - Redwood Inspection Service; www.redwoodinspection.com.
139. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
140. SDI - Steel Deck Institute; www.sdi.org.
141. SDI - Steel Door Institute; www.steeldoor.org.
142. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
143. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
144. SIA - Security Industry Association; www.siaonline.org.
145. SJI - Steel Joist Institute; www.steeljoist.org.
146. SMA - Screen Manufacturers Association; www.smainfo.org.
147. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
148. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.

149. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
150. SPIB - Southern Pine Inspection Bureau; www.spib.org.
151. SPRI - Single Ply Roofing Industry; www.spri.org.
152. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
153. SSINA - Specialty Steel Industry of North America; www.ssina.com.
154. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
155. STI - Steel Tank Institute; www.steeltank.com.
156. SWI - Steel Window Institute; www.steelwindows.com.
157. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
158. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
159. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
160. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
161. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
162. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
163. TMS - The Masonry Society; www.masonrysociety.org.
164. TPI - Truss Plate Institute; www.tpinst.org.
165. TPI - Turfgrass Producers International; www.turfgrasssod.org.
166. TRI - Tile Roofing Institute; www.tileroofing.org.
167. UBC - Uniform Building Code; (See ICC).
168. UL - Underwriters Laboratories Inc.; www.ul.com.
169. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
170. USAV - USA Volleyball; www.usavolleyball.org.
171. USGBC - U.S. Green Building Council; www.usgbc.org.
172. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
173. WASTEC - Waste Equipment Technology Association; www.wastec.org.
174. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
175. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
176. WDMA - Window & Door Manufacturers Association; www.wdma.com.
177. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
178. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
179. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
180. WPA - Western Wood Products Association; www.wwpa.org.

B. Standards and Regulations - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations:
   1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
   2. FED-STD - Federal Standard; (See FS).
   3. USAB - United States Access Board; www.access-board.gov.
   4. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

C. Code Agencies - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the Agency:
   1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   2. ICC - International Code Council; www.iccsafe.org.
   3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. State Government Agencies - Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents:
   1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
   2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
   3. CDHS - California Department of Health Services; (See CDPH).
   4. CDPH - California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
   5. CPUC - California Public Utilities Commission; www.cpuc.ca.gov.
   6. CBC – California Building Code (2016 Ed)
   7. CEC – California Electrical Code. (2016 Ed).
   8. CMC – California Mechanical Code. (2016 Ed).
   9. CFC – California Fire Code (2016 Ed).

1.6 SUBMITTALS

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 42 00

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products, including but not limited to:
   1. Product delivery, storage, and handling.
   2. Manufacturers' written warranties on products.
   3. Special warranties.
   4. Comparable products.

1.3 DEFINITIONS

A. Products:
   1. Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent:
      a. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
      b. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
      c. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

1.4 SUBMITTALS

A. Comparable Product Requests:
   1. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles:
      a. Include data to indicate compliance with the specified requirements.
      b. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of

receipt of additional information or documentation, whichever is later:
1) Form of Approval:
a) As specified in Section 01 33 00.
2) Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal:
1. Comply with requirements in Section 01 33 00. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options:
1. If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options:
a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 WARRANTY

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents:
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties:
1. Prepare a written document that contains appropriate terms and identification, ready for execution:
a. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
b. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time:
1. Comply with requirements in Section 01 77 00.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:
1. Schedule delivery to minimize long term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original

sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

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

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements:

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

B. Product Selection Procedures:

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

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

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

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration:
1. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   b. 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.
   c. Evidence that proposed product provides specified warranty.
   d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   e. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 73 00 EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Installation of the Work.
   2. Progress cleaning.
   3. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In Place Materials:
   1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible:
      a. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions:
   1. Before proceeding with the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00.

3.3 CONSTRUCTION LAYOUT

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

3.4 INSTALLATION

A. Locate the work and components of the work accurately, in correct alignment and elevation, as indicated.

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

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

D. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

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

F. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous. Materials containing asbestos and BCPs are prohibited.

3.5 PROGRESS CLEANING

A. Clean site and Work areas daily. Dispose of materials lawfully.

B. Site: Maintain work area free of waste materials and debris.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

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

END OF SECTION 01 73 00

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUBSTANTIAL COMPLETION

A. The items identified in the Contract Documents, including the Supplementary Conditions and the following items, shall be completed before Substantial Completion will be granted (also see Section 01 77 22: Substantial Completion Procedures):
   1. Contractor's Completion List (Punch List): Submit a thorough list of items to be completed or corrected, along with a written request for Substantial Completion and for review of the Work or portion of the Work. The Architect's Project Representative, at their discretion, may attend and assist in the preparation of the Contractor's Punch List.
   2. Architect's Supplemental Punch List: The Architect, along with the Owner at the Owner's discretion, will inspect the Work utilizing the Contractor's prepared Punch List, noting completed items and incomplete items, and will prepare a supplemental list of items that have been omitted or incomplete items that were not previously noted.
   3. Operations and Maintenance Manuals: Submit as described.
   4. Final Cleaning: Provide final cleaning and adequate protection of installed construction as described.

B. Date of Substantial Completion: Complete or correct items identified on Punch List and confirm that all items have been corrected prior to Architects re-inspection. Architect/Engineer, along with the Owner, will re-inspect the corrected work to establish the Date of Substantial Completion. Incomplete items remaining will be appended to the Certificate of Substantial Completion (AIA G704). The Date of Substantial Completion represents day one (1) of the closeout period, and represents the date of commencement of the Contractors correctional period and all warranty periods as described and required by the Contract Documents, except as amended in the Certificate of Substantial Completion and elsewhere in the Contract Documents.

C. Certificate of Substantial Completion: When the Work or designated portion thereof is substantially complete, Architect will prepare the Certificate of Substantial Completion to be executed by the Owner and Contractor. Items on the appended Punch List shall be completed or corrected within the time limits established in the Certificate.

1.3 PUNCH LIST

A. A comprehensive list prepared by the Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of work to be completed, if any. This list is intended to represent a limited number of items needing attention.

B. Punch lists shall be furnished to the Architect in Microsoft Excel and PDF formats.

C. Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for reinspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the work to be done.

D. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list:
   1. The Superintendent shall record or otherwise take note of all supplementary items.
   2. The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

1.4 PROJECT CLOSEOUT

A. Final Payment will not be authorized by the Architect until the Architect finds the Work acceptable under the Contract Documents, subject to the completion and acceptance of the following requirements and other applicable Contract requirements:
   1. Warranties, Certificates and Bonds: Execute and assemble transferable warranty documents, certificates, and bonds from subcontractors, suppliers, and manufacturers as described.
   2. Final Inspection and Acceptance by Architect is achieved as described.

1.5 FINAL CLEANING

A. Execute final cleaning prior to final project inspection and acceptance.

B. Remove smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces

C. Clean site; sweep paved areas directly impacted by construction activities.

D. Remove waste and surplus materials, rubbish, and temporary construction facilities from site.

1.6 WARRANTIES, CERTIFICATES, AND BONDS

A. Definitions:
   1. Standard Product Warranties:
      a. Preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
   2. Special Warranties:
      a. Written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide coverage of specific defects, or both.

B. In accordance with the general warranty obligations under the General Conditions as amended by the Supplementary Conditions, the General Contractor's warranty shall be for a period of one (1) year following the date of Substantial Completion, hereinafter called the one-year warranty period. The Contractors one-year general warranty shall include all labor, material and delivery costs required to correct defective material and installation. This warranty shall not limit the Owner’s rights with respect to latent defects, gross mistakes, or fraud.

C. The Contractor’s one-year warranty shall run concurrently with the one (1) year period for correction of Work required in the General Conditions.

D. No service charges or call out charges are allowed to investigate warranty claims.

E. In addition to the Contractors one-year warranty, Special Warranties as described in individual specifications sections, shall extend the warranty period for the period specified without limitation in respect to other obligations which the Contractor has under the Contract Documents.

F. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve the suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

G. Warranty Requirements:
1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
2. When Work covered by a warranty has failed and been corrected by replacement or reconstruction, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
4. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
5. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or designated portion of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

H. Compile copies of each required warranty properly executed by the Contractor and the subcontractor, supplier, or manufacturer. Verify documents are in proper form, contain full information, and are notarized. Co-execute warranties, certificates and bonds when required and include signed warrantees with Closeout Documents submitted to the Architect.

1.7 FINAL COMPLETION AND FINAL PAYMENT

A. Final Notice and Inspection:
1. When all items on the Punch List have been corrected, final cleaning has been completed, and installed work has been protected, submit written notice to the Architect that the Work is ready for final inspection and acceptance.
2. Upon receipt of written notice that the Work is ready for final inspection and acceptance, the Architect and Engineer will make final inspection.

B. Final Change Order: When the Project Closeout items described above are successfully completed and the Work is found acceptable to Architect/Engineer and Owner, a Final Change Order will be executed. This Change Order will include any Allowance adjustments as required by the Contract Documents.

C. Final Application for Payment: When all of the above items are successfully complete, submit to the Architect a final Application for Payment and request for release of retainage.

D. Release of Retainage: Release of retainage will not be authorized by the Architect until Contractor completes all requirements for close-out to the satisfaction of the Owner and Architect as described herein.

1.8 TERMINAL INSPECTION

A. Immediately prior to expiration of the one (1) year period for correction of the Work, the Contractor shall make an inspection of the work in the company of the Architect and the Owner. The Architect and the Owner shall be given not less than ten (10) days' notice prior to the anticipated date of terminal inspection.

B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Architect and the Owner, even if the date of completion of the corrective work may extend beyond the expiration date of the correction period.

C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner nor the replacement of parts necessitated by normal wear in use.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 77 00

SECTION 01 77 22 SUBSTANTIAL COMPLETION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 SUBMITTALS

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

1.4 SUBSTANTIAL COMPLETION PROCEDURES

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

B. Submittals Prior to Substantial Completion:
   1. Minimum of 10 days prior to requesting an inspection for determining date of Substantial Completion. List items that are incomplete at time of request:
      a. Certificates of Release: Obtain and submit releases from all (i.e. city, county, authorities) authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
      b. Submit closeout submittals, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
      c. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
      d. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

C. Procedures Prior to Substantial Completion:
   1. A minimum of 10 days prior to requesting inspection for determining date of Substantial Completion, submit list items that are incomplete at time of request:
      a. Instruct Owner's personnel in operation, adjustment, and maintenance of products. Complete final cleaning requirements, including touchup painting.
      b. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection:
   1. Submit written request for inspection to determine Substantial Completion a minimum

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

a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
b. Results of completed inspection will form the basis of requirements for final completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning:
   1. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions:
      a. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activites include but are not limited to:
         1) Clean site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
         2) Remove tools, construction equipment, machinery, and surplus material from Project site.
         3) Remove labels that are not permanent.
         4) Leave Project clean and ready for occupancy.

C. Construction Waste Disposal:
   1. Comply with waste disposal requirements.

END OF SECTION 01 77 22

SECTION 22 05 00 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 22 Sections, in addition to the General Requirements.

B. Plumbing work includes the following: furnish and install all piping and plumbing fixtures shown on the plumbing drawings and described in these specifications. In connection with this work, contractor shall also furnish and install all necessary work, devices, hardware, systems and services required to make said systems properly and safely operable, including, but not limited to, mounting hardware, framing, insulation, valves, flashing, cleanouts, cutting, concrete coring and cutting, patching and equipment installation.

1.2 WORK SEQUENCE

A. Install work in phases to accommodate Owner's construction requirements. Refer to Plumbing Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate plumbing schedule and operations with General Contractor and any other related subcontractor.

1.3 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work as required.

1.4 SUBMITTALS

A. Submit the following:

B. Proposed Products List: Include Products specified in the following Sections:

1. Division 22 - Plumbing.
2. Project Drawings

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Submittals shall be specific to the fixtures/device/unit being submitted; the data shall be highlighted or marked so as to be quite clear as to the fixtures/devices/units that shall be provided.

D. Equipment and materials shall be ordered only after satisfactory review by Owner and Engineer.

E. The following statement applies to all items reviewed. "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of

construction; coordination of his work with that of other trades; and the satisfactory performance of his work."

F. Contractor shall clearly mark the submittal sheet as to which model number, size, color, etc. when there is more than one choice available.

G. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.

H. Submittals shall have table of contents organized by specification section and shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings. .

1.5 REGULATORY REQUIREMENTS

A. Conform to 2016 California Building Code.

B. Plumbing: Conform to 2016 California Plumbing Code.

C. Electrical: Conform to 2016 California Electrical Code.

D. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.6 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of owner before proceeding.

C. PIPING LOCATIONS: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes. It is not the intent of the drawings to show necessary offsets required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.

D. CONSTRUCTION OBSERVATION: In addition to the requirement for obtaining inspections by the local jurisdiction, contractor shall notify Engineer at appropriate times during the construction process so that Engineer can visit site to become generally familiar with the progress and quality of contractor's work and to determine if the work is proceeding in general accordance with the contract documents.

E. SCALING OF DRAWINGS -In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime contractor shall request in writing that the architect or engineer provide clarification or the specific dimension.

F. AS EQUAL - For an item to be substituted "as equal" the contractor must provide to the engineer a complete submittal no later than 7 days prior to the bid opening. Contractor shall be responsible for any cost associated with the change including architectural design, mechanical, structural and electrical engineering and changes in any element of the building.

G. REMODELING CONTRACT / EXISTING CONDITIONS: The contractor shall, at its sole cost and expense, inspect the site of the proposed work to become fully acquainted with conditions relating to the work ant to fully understand the facilities, difficulties, and restrictions attending the execution of the work under the contract documents and cost therof.

1.7 QUALITY ASSURANCE

A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.

B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.

C. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

D. Provide products and materials that are new, clean, free from defects, damage, and corrosion.

E. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.

F. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power using equipment shall be meet the California energy efficiency standards as defined in the current Title 24 requirements.

G. District Standards for materials and equipment are available from the VUSD Facilities Department. Materials listed as district standards have been chosen in order to match other products already in use within the district as required for maintaining serviceability and spare parts in compliance with the California Public Contract Code

1.8 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, immediately and before commencing work, request clarification from Engineer.

B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.

C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.

D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

B. Adjust pipes, to accommodate the work to prevent interferences.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
2. Provide offsets, transitions, and changes in directions of pipes as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required.

3.2 COORDINATION OF WORK

A. The contract documents establish scope, materials, and quality but are not detailed installation instructions. Drawings are diagrammatic.

B. The contract documents show the general arrangement of equipment, ductwork, piping, and accessories. Provide offsets, fittings, and accessories which may be required but are not shown on the drawings. Investigate the site and review the other trades installation locations and requirements to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.

C. Whenever work interconnects with the work of other trades, coordinate to insure that all parties concerned have the necessary information required for a proper installation.

3.3 RECORD DRAWINGS

A. Maintain on a daily basis at the project site a complete set of record drawings reflecting an accurate dimensional record of all deviations between work sown on the drawing and that actually installed.

B. Provide licensed survey of exterior sewer pipe with inverts at building connections and cleanouts.

C. Provide two reproducible copies of the record drawing to the owner.

3.4 FINAL REVIEW

A. Provide to the owner a certification that all fixtures and equipment are properly functioning and adjusted.

END OF SECTION 22 05 00

SECTION 22 05 05 TRENCHING AND BACKFILLING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Excavating and backfilling for utility trenches.
2. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Divisions 22 and 23 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
F. Fill: Soil materials used to raise existing grades.
G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
H. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Backfill sand and soil.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 698 or ASTM D 1557 for each on-site and borrow soil material proposed for backfill.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.
3. Contact utility-locator service for area where Project is located before excavating.
4. Contractor shall make a plan and provide temporary utility services as required to maintain services to buildings operating during construction.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
B. Satisfactory Soils: As approved by the project Geotechnical consultant.
C. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
D. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
E. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
B. Prepare subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.
C. Protect and maintain erosion and sedimentation controls.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding. Project site and surrounding area.
B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system, to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXCAVATION FOR UTILITY TRENCHES

A. Underground alert: Before laying out piping and performing trenching, contactor shall determine locations of existing underground utilities. Contact "Dig Alert / Underground Service Alert of Southern California" - 1-800-422-4133. Contractor shall also contact owner's representative to ascertain locations of underground piping and other conditions affecting trenching, and shall perform testing and subsurface exploration as necessary to locate utilities.
B. Trenching: Material shall be excavated from trenches and piled adjacent to the trench. Material shall be piled in such a manner that will cause a minimum of inconvenience to public travel. All rock, boulders, and stones shall be removed to provide a minimum clearance of six (6) inches under and around pipes. Excavations shall be kept free of water. Trenches shall be dug to true and smooth bottom grades and in accordance with the lines indicated on drawings and as directed. Trench widths shall not exceed 30 inches or 1.5 times outside diameter of the pipe plus 18 inches, whichever is greater.

Minimum trench width shall be the outside diameter of pipe installed plus 12 inches. Depth of trenching for water and gas piping shall be such as to give a minimum cover of 18 inches over the top of the pipe. Deeper excavation may be required due to localized breaks in grade, or to install the new piping under existing culverts or other utilities where necessary. Trenching for sewers and drains shall be of sufficient width to permit proper jointing of the pipe and back filling of material along the sides of the pipe. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner. Trenches shall be excavated below the barrel of the pipe a sufficient distance to provide for bedding material where the trench bottom is in a material which is unsuitable for foundation or which will make it difficult to obtain uniform bearing for the pipe. Such material shall be removed and a stable foundation provided. This shall include the preparation of the native trench bottom and/or the top of the foundation material to a uniform grade so that the entire length of pipe rests firmly on a suitable properly compacted material (sand or gravel required). Gravel to be used for foundation purposes shall be of a type and gradation to provide a solid compact bedding in the trench.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade with bedding course.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.4 UTILITY TRENCH BACKFILL

A. Backfill: Contactor shall complete bedding and then backfill to 6 inches over the top of the pipe with sand before starting backfilling operations. Take all precautions necessary to protect the pipe from damage, movement and shifting. Compaction equipment used above the pipe zone shall be of a type that does not injure the pipe. Where original excavated material is unsuitable for trench backfill, backfill gravel shall be placed. Unsuitable material shall be removed to the disposal area. Whenever a trench is excavated in a paved roadway, sidewalk or other area where minor settlements would be detrimental and where native excavated material is not suitable for compaction as backfill, trench shall be backfilled with backfill gravel. Warning tape markers and tracer wires shall be installed during backfill operations. When working in an existing traveled roadway, restoration and compaction shall be achieved as the trench is backfilled so as to maintain traffic. Provide temporary, traffic-bearing steel plates over excavations in public rights-of-way, if backfilling and re-paving cannot be accomplished before end of work period. Trench backfill under roadway shall be mechanically compacted to 95 percent of maximum density except for trenches over 8 feet in depth. In any trench in which 95 percent density cannot be achieved with existing backfill, the top 4 feet shall be replaced with backfill gravel mechanically compacted to 95 percent. The method of compaction shall be at contractor's option, unless excavation permit requires a specific type. Contractor shall be responsible to provide the proper size and type of compaction equipment and select the proper method of utilizing said equipment to attain the required compaction density. Compaction by water jetting will not be permitted. Where backfill is

required to be certified, compliance shall be performed in accordance with the requirements of the governing authority. Allow testing service to inspect and approve each subgrade and fill layer before further fill, backfill or construction work is performed.

B. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

C. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

D. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 22 05 05

SECTION 22 05 10 PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, notes, and general provisions of the Contract, including General and Supplemental Conditions and Division 01 specification sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings for domestic water, and waste & vent.
2. Escutcheons.
3. Cleanouts.

1.3 REFERENCES

A. ANSI B31.9 - Building Service Piping.

B. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

C. ASTM A74 - Cast Iron Soil Pipe and Fittings.

D. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

E. ASTM B32 - Solder Metal.

F. ASTM B88 - Seamless Copper Water Tube.

G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

H. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

I. ASTM D2235 - Solvent Cements for Acrylonitrile Butadiene Styrene (ABS) Pipe & Fittings.

J. ASTM D2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).

K. ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

L. ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

M. ASTM D2661 - Acrylonitrile Butadiene Styrene (ABS) Drain, Waste and Vent Fittings.

N. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.

O. ASTM D3034 - Poly Vinyl Chloride (PVC) Plastic Sewer Pipe SDR-35.

P. ASTM D3965 - Acrylonitrile Butadiene Styrene (ABS) Plastic Pipe.

Q. ASTM 306 – Drain, Waste, & Vent (DWV) Copper tube & fittings.

R. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

S. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

T. NSF – Third Party Testing for No-hub Couplings.

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Piping and fittings.
2. Escutcheons.
3. Cleanouts.

B. Project Record Documents

1. Submit the following:
2. Record actual locations of valves and piping.

C. Operation and Maintenance Data

1. Submit the following:
2. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 REGULATORY REQUIREMENTS

A. Construction shall comply with the California Code of Regulations, Title 24, including the 2016 California Building code and the 2016 California Plumbing Code

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of the general requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.8 RECORD DOCUMENTS

A. Accurately record results of exploratory investigations regarding locations and characteristics of existing buried pipelines and conduits, for Record Documents

B. Accurately record locations of constructed pipelines, fittings, valves, connections and appurtenant structures, including depth below finish grade to waterlines and invert

elevations of sewer, for Record Documents.

C. Accurately record changes from construction identified on Drawings and Specifications, including unexpected physical conditions and unmarked or inaccurately marked existing utilities, for Record Documents

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. SEWER PIPE: ABS DWV SCH.40 PIPE & FITTINGS –ASTM-D3965.

1. All ABS waste piping shall be manufactured in the United States

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless, service weight, U.S. manufactured.

1. Fittings: Cast iron, U.S. manufactured.
2. Joints: ASTM C564, neoprene gasket system with 4-band NSF – Certified stainless steel band clamps.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight, U.S. manufactured.

1. Fittings: Cast iron, U.S. manufactured.
2. Joints: Neoprene gaskets with 4-band NSF – Certified stainless steel band clamps-and-shield assemblies.

2.4 WATER PIPING, BURIED, WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88, Type k, soft, U.S. manufactured.

1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, lead-free solder, Silver bearing. Bridget or Equal. Braze underground parts.
3. Transitions from underground PVC to above ground copper tubing shall be made with male PVC fitting to female copper fittings. Provide brass unions.

2.5 WATER PIPING, BURIED, BEYOND 5 FEET OF BUILDING

A. PVC Pipe: ASTM D1785, Schedule 80.

1. Fittings: ASTM D2466, PVC. Male PVC threaded fitting at connection to copper tubing.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.6 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn, U.S. manufactured.

1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B32, lead-free solder, Silver bearing. Bridget or Equal

2.7 ESCUTCHEONS

A. Escutcheons for gas, condensate, water and waste, and vent piping penetrations.

1. Manufacturers: subject to compliance with requirements, provide products by the following:
   a. Brasscraft.
   b. or equal
2. Description: chrome-plated cast brass with set screws.

2.8 CLEANOUTS

A. Cleanouts for waste piping.

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:

   a. J.R. Smith
   b. Zurn.

2. Description: cast-iron with threaded bronze plug. 18 gage stainless cover with vandal-proof screws for wall cleanout. Polished brass non-slip cover for floor cleanout. Concrete box for cleanout to grade.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings. Valves shall be easily accessible.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Establish elevations of buried piping outside the building to ensure not less than 30 inch of cover. Exception: Localized areas may be 18” deep to accommodate existing conditions.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

L. Excavate in accordance with this Section for work of this Section.

M. Backfill in accordance with this Section for work of this Section.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted.

P. Underground Alert: Before laying out piping and performing trenching, contractor shall determine locations of existing underground utilities. Contact "Dig Alert / Underground Service Alert of Southern California" - 1-800-422-4133. Contractor shall also contact District's representative to ascertain locations of underground piping and other conditions affecting trenching, and shall perform testing and subsurface exploration as necessary to locate utilities. Do not perform trenching until all utilities have been located and marked.

Q. Trenching: Material shall be excavated from trenches and piled adjacent to the trench. Material shall be piled in such a manner that will cause a minimum of inconvenience to public travel. All rock, boulders, and stones shall be removed to provide a minimum clearance of six (6) inches under and around pipes. Excavations shall be kept free of water. Trenches shall be dug to true and smooth bottom grades and in accordance with the lines indicated on drawings and as directed. Trench widths shall not exceed 30 inches or 1.5 times outside diameter of the pipe plus 18 inches, whichever is greater. Minimum trench width shall be the outside diameter of pipe installed plus 12 inches. Depth of trenching for water and gas piping shall be such as to give a minimum cover of 18 inches over the top of the pipe. Deeper excavation may be required due to localized breaks in grade, or to install the new piping under existing culverts or other utilities where necessary. Trenching for sewers and drains shall be of sufficient width to permit proper jointing of the pipe and back filling of material along the sides of the pipe. Trench width at the surface of the ground shall be kept to the minimum amount necessary to install the pipe in a safe manner. Trenches shall be excavated below the barrel of the pipe a sufficient distance to provide for bedding material where the trench bottom is in a material which is unsuitable for foundation or which will make it difficult to obtain uniform bearing for the pipe. Such material shall be removed and a stable foundation provided. This shall include the preparation of the native trench bottom and/or the top of the foundation material to a uniform grade so that the entire length of pipe rests firmly on a suitable properly compacted material (sand or gravel required). Gravel to be used for foundation purposes shall be of a type and gradation to provide a solid compact bedding in the trench.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade with bedding course.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

R. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

S. Backfill: Contactor shall complete bedding and then backfill to 6 inches over the top of the pipe with sand before starting backfilling operations. Take all precautions necessary to protect the pipe from damage, movement and shifting. Compaction equipment used above the pipe zone shall be of a type that does not injure the pipe. Where original excavated material is unsuitable for trench backfill, backfill gravel shall be placed. Unsuitable material shall be removed to the disposal area. Whenever a trench is excavated in a paved roadway, sidewalk or other area where minor settlements would be detrimental and where native excavated material is not suitable for compaction as backfill, trench shall be backfilled with backfill gravel. Warning tape markers and tracer wires shall be installed during backfill operations. When working in an existing traveled roadway, restoration and compaction shall be achieved as the trench is backfilled so as to maintain traffic. Provide temporary, traffic-bearing steel plates over excavations in public rights-of-way, if backfilling and re-paving cannot be accomplished before end of work period. Trench backfill under roadway shall be mechanically compacted to 95 percent of maximum density except for trenches over 8 feet in depth. In any trench in which 95 percent density cannot be achieved with existing backfill, the top 4 feet shall be replaced with backfill gravel mechanically compacted to 95 percent. The method of compaction shall be at contractor's option, unless excavation permit requires a specific type. Contractor shall be responsible to provide the proper size and type of compaction equipment and select the proper method of utilizing said equipment to attain the required compaction density. Compaction by water jetting will not be permitted. Where backfill is required to be certified, compliance shall be performed in accordance with the requirements of the governing authority. Allow testing service to inspect and approve each subgrade and fill layer before further fill, backfill or construction work is performed.

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See section W below for special backfill requirements for buried cast iron piping.

T. Seal all penetrations through exterior walls and fire rated walls with 3M Firestopping materials for fire rating capacity per the architectural plans and CBC requirements.

U. Test all piping per 2016 California Plumbing Code Requirements.

V. Disinfect piping.

W. Buried Cast Iron Piping. All buried cast iron pipe shall be double wrapped with 8-mil polyethylene (Polywrap), and provide backfill 6” minimum all around pipe using clean sand backfill, with testing performed by a corrosion engineering laboratory. The sand shall meet the following requirements:

1. Minimum saturated resistivity of no less than 3,000 OHM-CM.
2. pH between 6.0 and 8.0.

3. Chloride content of less than 150 PPM.
4. Sulfate content of less than 1,000 PPM.
5. Ammonium concentration less than 10 PPM.
6. Nitrate concentration less than 50 PPM.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

B. Slope water piping and arrange to drain at low points.

END OF SECTION 22 05 10

SECTION 22 05 23 GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Hydrants.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

F. Lead Content: Comply with State of California laws SB1334.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC. S-685-80-LF less than 2"; NIBCO INC. T-113-LF 2" or larger.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Sweat.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 VALVE BOXES

A. MANUFACTURERS

1. Christy – Concrete Box
2. or equal

B. Install with lid identifying type of service.

2.4 HYDRANTS

A. Hydrants

1. Manufacturer: subject to compliance with requirements, provide products by the following:
   a. J.R. Smith.
   b. Zurn.
   c. Nibco.
   d. Watts.
2. Lead-free compliant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Domestic Water Shutoff Service: Ball valves.
2. Throttling Service: Globe valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, 2”and Smaller: Soldered ends.
2. For Copper Tubing, 2-1/2” to NPS 4”. Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, 2-1/2” and Smaller: Threaded ends.
4. For Steel Piping, 2-1/2” TO 4”. Flanged ends except where threaded valve-end option is indicated in valve schedules below.
5. For Steel Piping, NPS 5 and Larger: Flanged ends.
6. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

END OF SECTION 22 05 23

SECTION 22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. Retain this article if these devices will identify some or all piping. Identification of piping by color-coded painting is covered in "Pipe Label Installation" Article.

B. Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.

C. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each water heater and pumps.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:
   a. Background Color: White.
   b. Letter Color: Blue (Cold) Red (Hot).
2. Sanitary Waste, Rainwater, and Condensate Drain Piping:
   a. Background Color: Black.
   b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 40 00 PLUMBING FIXTURES AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Included are kitchen and architectural drawings.

1.2 SUMMARY

A. This Section includes the following plumbing fixtures, equipment, and related components:

1. Drinking Fountain.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

C. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

D. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

E. FRP: Fiberglass-reinforced plastic.

F. PMMA: Polymethyl methacrylate (acrylic) plastic.

G. PVC: Polyvinyl chloride plastic.

H. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lift stations that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures of unit shell.
   b. Faulty operation of controls, pumps, and alarm.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAIN

A. Drinking Fountain:

1. Manufacturers: subject to compliance with requirements, provide products by the following:

   a. See Plumbing Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install lift station at location shown on plans with all necessary conduit, piping, floats, control panel, basin, and other necessary materials for a complete functioning lift station. Install 10 feet of soldered copper piping downstream of pumps. Provide vent to roof per plans. Verify depth of sewer inlet prior to placing basin. Coordinate with electrician. Provide check valve on outlet of pump.

C. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

D. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

E. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

F. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

G. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

H. Install new pre-packaged sump system per details on plans with all piping, wiring, and controls for a working system.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 26 00 00 GENERAL PROVISIONS

PART 1 GENERAL

A. The general contract provisions apply to this section and take precedent over this section in case of conflict.

1.1 GENERAL PROVISIONS

A. This division supplements the applicable requirements of other divisions.

1.2 DEFINITIONS

A. For the purposes of Division 260000, the following definitions apply:
   1. Provide: Furnish and install.
   2. Indicated: As shown on the drawings or specified herein.
   3. Circuit Designation: Panel designation and circuit number, i.e., LA-13.
   4. Approved equal: Approved by the engineer of record as equal in his sole determination.

1.3 SCOPE OF WORK

A. The Specifications for Work of Division 260000 include, but are not limited to the following sections:
26 0000–General Provisions
26 0030–Tests and Identification
26 0050–Basic Electrical Materials and Methods
26 0060–Minor Electrical Demolition for Remodeling
26 0111–Conduits
26 0115–Wireways
26 0120–Conductors
26 0130–Electrical Boxes
26 0133–Terminal Cabinets
26 0140–Wiring Devices
26 0142–Nameplates and Warning Signs
26 0163–Distribution Panelboards
26 0164–Branch Circuit Panelboards
26 0170–Disconnects
26 0190–Support Devices
26 0585–Horizontal Boring System
26 2450–Grounding
26 4721–Fire Alarm and Detection System
26 4745–Networking & Data Communications
26 4750–Cabling and Distribution System
26 4770–Audio/Paging System
26 4901–General Control Devices

B. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this division, complete, as shown on the

drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all divisions for related work required to be included as work under this division.
2. General provisions for electrical work.
3. Site observation including existing conditions.

C. Related Work Specified Elsewhere but included in the scope of work:
   1. Motors and their installation.
   2. Control wiring and conduit for heating, ventilating and air conditioning.

D. Work Not In Contract (N.I.C.):
   1. Telephone instruments.

E. Coordination
   1. The following supplements are additional General Requirements pertaining to work of this Division. Provisions of Division 1 - General Requirements shall remain in effect.
      a. Coordinate work of various sections of Division 26 and 27.
      b. Coordinate work of this Division 26 with work of Divisions 2 through 25.

1.4 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

B. Association of Edison Illuminating Companies (AEIC).

C. Electrical Testing Laboratories (ETL).

D. Illuminating Engineering Society (IES).

E. Institute of Electrical and Electronic Engineers (IEEE).

F. Insulated Cable Engineers Association (ICEA).

G. National Electrical Manufacturers Association (NEMA).

H. National Fire Protection Association (NFPA).

I. Underwriters Laboratories, Inc. (UL).

J. California State Fire Marshal (CSFM).

K. California Energy Commission (CEC) Title 24.

1.5 QUALITY ASSURANCE

A. Regulations: All the electrical equipment and materials, including their installations, shall conform to the following applicable latest codes and standards:
   1. California Electric Code, Latest Adopted Edition (CEC), 2016 unless a more current version has been adopted.
   2. Local and State Fire Marshal.
   3. Occupational Safety and Health Act (OSHA).

4. Requirements of the Serving Utility Company.
5. Local Codes and Ordinances.
6. Requirements of the Office of the California State Architect (OSA).
7. California Administrative Code, Title 8, Chapter 4, Industrial Safety Orders.
8. California Administrative Code, Title 24.
9. County of Los Angeles Codes and Regulations.

B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply. In instances where plans and specifications are at variance or conflict the most restrictive requirement shall apply. Contractor shall be responsible for all his associated work and materials and also the work and materials of related or affected trades.

C. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, and pay for all taxes, fees and utility charges required for the electrical work.

D. Testing and Adjustment:
1. Perform all necessary tests required to ascertain that the electrical system has been properly installed, that the power supply to each item of equipment is correct, and that the system is free of grounds, ground faults, and open circuits, that all motors are rotating in the proper directions, and such other tests and adjustments as may be required for the proper completion and operation of the electrical system. Contractor shall provide a copy of all test reports to prove these tests have been performed.
2. If, during the course of testing, it is found that system imbalance is in excess of 20%, rearrange single-pole branch circuit in lighting and receptacle panels to bring system balance to within 20% on all phases. Record all such changes on the typewritten panelboard schedule and submit a summary of changes to the Engineer on the record drawings.

1.6 SUBMITTALS

A. Procedure: In accord with the Submittal Section.

B. Shop drawings: Detailed shop drawings for the following equipment:
1. Distribution panelboards.
2. Branch circuit panelboards.

C. Product data: Detailed manufacturer’s data for:
1. Cabinets.
2. Concrete pull boxes.

D. Test results for the following:
1. Grounding systems.
2. Cables.

E. Include sufficient information to indicate complete compliance with Contract Documents. Include illustrations, catalog cuts, installation instructions, drawings, and certifications. On each sheet show manufacturer's name or trademark.

F. Operating, maintenance, and instruction data for:
1. None required.

G. Instruction materials:

1. Provide at the time of personnel instruction period three bound copies of instruction manuals for the systems as listed in Subparagraph 1.04.A.4.f.
2. Include the following (minimum) information in each copy of instruction manual:
   a. Manufacturers' names and addresses including phone numbers.
   b. Serial numbers of items furnished.
   c. Catalog cuts, exploded views and brochures, complete with technical and performance data for all equipment, marked to indicate actual items furnished and intended use.
   d. Recommended spare parts.

1.7 OWNER'S PERSONNEL INSTRUCTIONS

A. Prior to completion of the contract, and at the Owner's convenience, instruct verbally and demonstrate to the Owner's personnel, the operation of the systems as listed under operating, maintenance, and instructional data for fire alarm annunciator panel.

1.8 CLEANING

A. Clean exterior surfaces and interiors of equipment and remove all dirt, cement, plaster and other debris. Protect interior of equipment from dirt during construction and clean thoroughly before energizing.

B. Clean out cracks, corners and surfaces on equipment to be painted. Remove grease and oil spots so that paint may be applied without further preparation.

1.9 PROJECT RECORD DOCUMENTS - PREPARE THE FOLLOWING AND SUBMIT TO THE ENGINEER BEFORE FINAL ACCEPTANCE:

A. Mark Project Record Documents daily to indicate all changes made in the field.
   1. In addition to general requirements of Project Record Drawings, indicate on drawings, changes of equipment locations and ratings, trip sizes, and settings on circuit breakers, alterations in raceway runs and sizes, changes in wire sizes, circuit designations, installation details, one-line diagrams, control diagrams and schedules.

B. Use green to indicate deletions and red to indicate additions.
   1. Use the same symbols and follow the same drafting procedures used on the Contract Drawings.

C. Locate dimensionally off of contract drawings all underground conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations using building lines by indicating on the Project Record Drawings.

D. At the completion of underground conduit installation provide underground conduit record documents to owner’s representative.

E. Two copies, in binder form, of all test results as required by these specifications - 260030.

F. Two copies of local and/or state code enforcing authorities final inspection certificates.

G. Two copies, in binder form, of electrical equipment cut sheets, manufacturer’s installation instructions, warranty certificates, and product literature for all products utilized on project.

1.10 SERVICE INTERRUPTIONS AND UTILITY

A. Coordinate with the Owner the interruption of services necessary to accomplish the work.

B. Coordinate with the utility company all work associated with power and communications distribution systems and service entrance equipment.

C. Electrical contractor shall supply temporary power for all trades.

1.11 MINIMUM SPECIFICATION REQUIREMENTS (ALL WORK OF DIVISION 260000)

A. As a minimum Specification requirement, all materials and methods shall comply with applicable governing codes.

1.12 PENETRATION SEALING

A. Seal penetration through exterior walls and fire rated walls, floors, ceilings, and roofs with 3M Firestopping materials of fire rating capacity rated per architectural plans and UBC or prevailing building code requirements.

1.13 PLACING EQUIPMENT IN SERVICE

A. Do not energize or place electrical equipment in service until all interested parties have been duly notified and are present or have waived their rights to be present. Where equipment to be placed in service involves service or connection from another contractor of the owner, notify the owner in writing when the equipment will be ready for final testing/connection and schedule to the owner's satisfaction of this service connection. Notify the owner two weeks in advance of the date the various items of equipment will be complete.

1.14 OWNER-FURNISHED ITEMS

A. Pick up Owner-furnished items and handle, deliver, install, and make all final connections.
   1. Assume responsibility for the items when consigned at the storage facility or in the field in accord with requirements of the Contract Documents.

1.15 ELECTRIC ITEM LOCATION

A. Electrical drawings are generally diagrammatic. Verify equipment sizes with shop drawings and manufacturers' data and coordinate location layout with other trades. Notify owner and engineer of any changes of location requirements prior to installation and obtain engineer's written acceptance for all changes/revisions.

1.16 DEMOLITION

A. Scope: Provide and perform demolition, preparatory and miscellaneous work as indicated and specified, complete.

B. Principle Items of Work:
   1. Demolition and removal of existing electrical conduit, wiring and equipment required to complete the project.
   2. Preparation of the existing building to receive or connect the new work.
   3. Miscellaneous demolition, cutting, alteration, and repair work in and around the existing building necessary for the completion of the entire project.
   4. Disconnecting and reconnection of electrical equipment as required by the construction modifications.

C. Existing Conditions: Make a detailed survey of the existing conditions pertaining to the work. Check the locations of all existing structures, equipment and wiring (branch circuiting and controls). Provide at bid time any exclusions for existing conditions work.

D. Salvage and Disposal: All removed material other than items to be reused shall be returned to the owner or disposed of in accordance with instructions from the owner's representative. Disposal shall be done in accordance with EPA and governing body requirements and regulations. Contractor shall pay all fees and charges for disposal.

1.17 ELECTRICAL WORKMANSHIP REQUIREMENTS

A. It is required that all electrical construction of this Contract be performed by journeyman electricians. All journeyman electricians shall have a minimum of 4 years of apprenticeship training and hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards. This is intended to mean that a person who does not hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards will not be permitted to do electrical work of any kind that involves new construction, nor make repairs, alterations, additions, or changes of any kind to any existing system of electrical wiring, apparatus, equipment, light, heat, or power.

B. Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under direct and constant personal supervision of a journeyman electrician holding a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.
   1. Each journeyman electrician will be permitted to be responsible for quality of workmanship for a maximum of eight helpers or apprentices during any same time period, provided the nature of work is such that good supervision can be maintained and quality of workmanship achieved is the best, as expected by Owner and as implied by the latest edition of the California Electrical Code (National Electrical Code with State of California amendments).
   2. Before each journeyman electrician commences work, deliver to Owner at project site a photocopy of journeyman's valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

C. All electrical systems shall be installed in a neat and workmanlike manner per National Electrical Code requirements and ANSI approved NEIS National Electrical Installation Standards.

1.18 DESIGN CHANGES AFTER AWARD OF BID

A. When a change in the quantity or size of conductors is made, the conduit size will remain in accordance with that indicated in the original contract drawings rather than the drawing symbol conduit table. When code permits, provide conductor insulation 'THWN' where required to maintain conduit fill conformance with the National Electrical Code.

1.19 MATERIAL AND EQUIPMENT SUBSTITUTION

A. Where two or more trade names or manufacturers are mentioned, selection shall be made from the group listed for use in the base bid. The order in which names are listed is not intended to be any indication of preference.

B. Where a single manufacturer, product or trade name is stated, that manufacturer, product or trade name shall be used in the base bid. The use of other manufacturers, products or trade names will be considered by the engineer of record (unless that product is indicated for no substitution) only if submitted as alternate items at the time of bidding, with evidence of equality and a statement of net price difference as compared to the specified item. After approval by the engineer of record, the architect and owner reserve the right to review such submittals and to determine the acceptability for use.

C. Equipment other than that specified will be accepted only when written approval is given by the engineer of record and architect, in accordance with Division 1.

D. The contractor shall be held responsible for all physical changes in piping, equipment, etc. resulting from equipment substitution and likewise bear any increased cost of other trades in making said substitution. Approval by the architect of equipment other than that specified does not relieve this contractor of this responsibility.

1.20 REQUESTS FOR INFORMATION

A. The contractor shall submit all requests for information (RFI's) typewritten on architect's form.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

NOT USED.

END OF SECTION 26 00 00

SECTION 26 00 30 – TESTS AND IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Tests and identification.

1.2 SUBMITTALS

A. In accord with Section 260000.

B. All test values.

1.3 DEFINITION

A. Circuit designation: This term is construed to mean panel designation and circuit number; i.e., LA-13.

1.4 TESTS AND ADJUSTMENTS

A. Prior to energizing, test all systems. Test to ensure systems are:
   1. Free from short circuits and grounds.
   2. Free from mechanical and electrical defects.

B. Ground systems:
   1. Visual and mechanical inspection: Verify ground system is in compliance with Drawings and Specifications.
   2. Electrical tests:
      a. Perform fall-of-potential test or alternative in accord with IEEE 81 on the main ground electrode or system.
      b. Perform point-to-point tests to determine resistance between main ground system and all major electrical equipment frames, system neutral, and/or derived neutral points.
   3. Test values:
      a. Resistance between main ground electrode and ground shall be no greater than 10 ohms. Additional rods shall be installed and bonded to grounding system and driven to a depth of 50 ft. or refusal, whichever comes first.
      b. Investigate point-to-point resistance values which exceed 0.5 ohm.
      c. Record all test values and provide certified copies to Owner.

C. Cables:
   1. Make insulation resistance tests on all power cables, using a self-contained instrument such as the direct-indicating ohmmeter of the generator type, or “megger” such as manufactured by J.G. Biddle Company, or Owner-approved equivalent. Insulation resistance values shall be at least 75% of shop test records.
      a. Apply the following test voltages for 1 minute, except where specified otherwise herein, in accord with procedure recommended by manufacturer of test equipment and as specified herein.

Rated Circuit	Megger	Minimum Megger

Voltage	Voltage (DC)	Reading
600 volts	500 volts	600 kilohms

2. Record all test values and provide certified copies to Owner.
3. Replace cables not meeting specified resistance values.

1.5 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all electrical distribution equipment shown on single-line diagram, and on control panels, dimmer panels, terminal cabinets, and separately mounted circuit breakers, disconnects, and starters.

B. Provide equipment and circuit designation on nameplates with minimum letter and plate sizes as indicated.

C. Provide engraved plastic nameplates with 1/4 in. minimum height letters indicating:
1. Circuit designation at branch overcurrent devices in distribution panelboards, switchboards, and motor control centers.
2. Circuit designation of panel, equipment-controlled or device-controlled on disconnect switches and on circuit breakers, starters, and controls which are individually enclosed.
3. Voltage rating and circuit designation of all outlets larger than 120V, 20A rating and more than 2 poles.
4. Designation of control and terminal cabinets including CUTC, as indicated.
5. Designation of each contactor and relay in control cabinets.
6. Designate area controlled for each dimmer in dimmer cabinet or rack.
7. Circuit designation at all ground fault detectors and ground fault test receptacles.
8. Equipment designation on front of switchboards, distribution panelboards, branch circuit panelboards, and load centers.

D. Secure nameplates with at least two rivets. Cementing and adhesive installation is not acceptable.

E. Provide two copies of a typewritten directory for each branch circuit panelboard, showing each circuit and its use. Attach one copy to panelboard door and deliver the other copy to Owner.

F. Provide caution label on branch circuit panelboards with integral control compartments. Caution label shall be red with white letters reading "CAUTION, EXTERNAL CONTROL VOLTAGE CIRCUIT WITHIN THIS PANEL."

G. Conductor identification:
1. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices, and in pull boxes.
2. Branch circuits: Identify with corresponding circuit designation at overcurrent device and at all splices.
3. Control wires: Identify with indicated number and or letter designation at all terminal points and connections, including manufacturer pre-wired control sections and cabinets.
4. Alarm and detection wires: Identify with indicated wire and mnemonics numbers at all connections, terminal points, and coiled conductors within cabinets for future termination by Owner.
5. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Permasleeve with type written identification.

END OF SECTION 26 00 30

SECTION 26 00 50 BASIC ELECTRICAL MATERIALS & METHODS

PART 1 GENERAL

1.1 DESCRIPTION: DIVISION 1 APPLIES TO THIS SECTION. THIS SECTION CONTAINS GENERAL REQUIREMENTS FOR THE SECTIONS IN DIVISION 26.

A. Related Work Not in Division 26: Refer to individual Division 26 Sections.

1.2 QUALITY ASSURANCE:

A. Codes: Entire installation shall comply with requirements of authorities having jurisdiction.

B. Permits: Contractor shall pay for all permits required by work under this Division.

C. Inspections: Contractor shall arrange for all inspections and correct non-complying installations.

1.3 SUBMITTALS: REFER TO DIVISION 1 FOR PROCEDURES.

A. Material and Equipment: Prior to start of work, 6 copies of a list of all materials and equipment covered by Division 26 shall be submitted for approval. Contractor shall allow ample time for checking and processing and shall assume responsibility for delays incurred due to rejected items. No installation of material concerned shall be made until such written approval has been obtained. Approval of materials and equipment shall in no way obviate compliance with the Contract Documents. Each item proposed shall be referenced to the applicable Section, Page, and Paragraph of Division 26. For each item proposed, give name of manufacturer, trade name, catalog data, and performance data.

B. Equipment Layout Drawings: Submit "Equipment Layout Drawings" for each equipment room or area containing equipment items furnished under this Division. Layout Drawings shall consist of plan view of room, to scale, showing projected outlines of all equipment, complete with dotted line indication of all required clearances including all those needed for removal or service. Location of all conduit and pull boxes shall be indicated.

C. Service Manuals: Refer to Submittal Section. Indexed Service Manuals shall be submitted which shall include test reports, service instructions, and renewal parts lists of all equipment.
   1. Submission and Information: Service Manuals shall be submitted for approval at least 30 days before final inspection. The following information together with any pertinent data, shall be included in Service Manual:
      a. Renewal part numbers of all replaceable items.
      b. Manufacturer's cuts and rating data.
      c. Serial numbers of all principal pieces of equipment.
      d. Supplier's name, address, and phone number.
      e. Final settings for all breakers, relays, and control devices
   2. Copies: Four (4) copies of approved Service Manual shall be delivered on or before date required.

D. Record Drawings: Prepare and submit in accordance with requirements. Contractor shall make notations, neat and legible, daily as the work proceeds. Drawings shall be available for inspection at all times and kept at the job site. All buried conduit and/or indicated future connections outside any building shall be located both by depth and by accurate measurement from a permanently established landmark such as a building or structure.

E. Seismic Calculation: Per California Building Code & DSA.

F. Spare Parts: Conform to the Submittal Section. Deliver following spare parts to Owner and obtain receipts. Submit at same time as Operating Instructions:
1. Spare fuses; 1 set for each combination fuse breaker.
2. Spare pilot light lamps of each type used on project, in quantity of 10%, but not less than 2%.
3. Overload heater elements; 2 sets for each size used on project.

G. Special Tools: If any part of the equipment furnished under Division 26 requires a special tool for assembly, adjustment, resetting, or maintenance thereof and such tool is not readily available on the commercial tool market, it shall be furnished with the equipment as a standard accessory and delivered to the Owner.

H. Maintenance Paint: One (1) can of touch-up paint shall be delivered to Owner for each different color factory finish which is to be the final finished surfaces of the product.

1.4 DRAWINGS:

A. Diagrammatic Drawings: For purposes of clarity and legibility, drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible, Contractor shall make use of data in all the Contract Documents and verify information at building site.

B. Routing of Conduit and Piping: The drawings indicate required size and termination of conduits and raceways. It is not intent to indicate all necessary offsets and it shall be the responsibility under this Division to install conduit in such a manner as to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without extra cost to the Owner.

C. Coordination with Other Trades: Check with other Divisions of the Specifications so that no interference shall occur and in order that elevations may be established for the work. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Architect.

1.5 DAMAGE AND REPAIRS:

A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding Contractor's warranty or relieving Contractor of his responsibility during warranty period.

B. Responsibility for Damage: Contractor shall be responsible for damage to grounds, buildings, or equipment due to work furnished or installed under this Division 26.

1.6 PROTECTION, CARE, AND CLEANING:

A. Protection: Provide adequate protection for finished parts of materials and equipment against physical damage from any cause during progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.

B. Care: During entire construction, properly cap all lines and equipment to prevent entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.

C. Cleaning: After installation is completed, clean all systems as follows in addition to requirements specified:
   1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment exposed in completed structure; removing all rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.
   2. Factory Finished Items: Remove grease and oil on all factory finished items such as cabinets and controllers, and leave surfaces clean and polished.

D. Connection: Prior to energizing, check all electrical connection hardware and torque where necessary.

PART 2 PRODUCTS

2.1 PRODUCTS: Products and materials shall be as specified in the pertinent Sections of Division 26.

2.2 MATERIALS AND EQUIPMENT: Wherever possible, all materials and equipment used in installation of this work shall be of same manufacturer throughout for each class of material or equipment. Materials shall be new and bear UL label, wherever subject to such approval. Comply with ANSI, IEEE and NEMA standards, where applicable.

PART 3 EXECUTION

3.1 SEISMIC REQUIREMENTS: Electrical equipment for emergency systems shall be braced to withstand the lateral forces that result from earthquakes. Under Work of Division 26, submit seismic calculations stamped and signed by a registered California structural engineer confirming size, number, and location of required anchoring hardware. Electrical equipment vendors shall furnish weights together with dimensions and the center of gravity location for all emergency electrical equipment for this purpose.

3.2 GENERAL LATERAL BRACING REQUIREMENTS: As shown on Drawings. Additional bracing requirements shall conform to specific requirements shown on Drawings or in other Sections of Division 26. Anchorages for equipment subject to thermal expansion and movement shall conform to manufacturer's recommendation and intent of general bracing requirements. When general and specific bracing requirements enumerated above are in conflict with referenced standards, the most stringent requirements shall govern.

3.3 EXCAVATION AND BACKFILL: Perform all excavation and back fill required to install Work of Division 26, both inside and outside. Perform all excavation and backfilling in accordance with Division 2.

A. Excavation: Bury conduits outside building to a depth of not less than 24" (or as required by Code) below finish grade, unless noted otherwise.

B. Backfilling: Do not backfill until after final inspection and approval of conduit installation by all legally constituted authorities and recording of the buried items on the Record Drawings.

3.4 CUTTING AND PATCHING:

A. Cutting of Existing Structural Work: Holes in existing slabs and concrete walls shall be cored to the minimum size required. The Contractor shall submit Drawings showing dimensioned sizes and locations for all such holes to Architect for approval before cutting. Where required for conduit installation, slabs on grade shall be saw-cut to minimum required

width; submit cutting Drawings to the Architect for approval before cutting.

B. Patching: Holes or chases shall be patched to match adjacent surfaces.

3.5 CONCRETE WORK: Concrete construction required for the Work of Division 26 shall be provided under the Work of Division 26.

3.6 PAINTING: Finish painting of electrical equipment will be as specified in Division 9, unless equipment is herein specified to be furnished with factory applied finish coats. Equipment to be field painted shall be furnished with a factory applied prime coat.

A. Touch-Up: If factory finish on any equipment furnished under Division 26 is damaged in shipment or during construction of building, the equipment shall be refinished by Contractor to satisfaction of Architect.

B. Concealed Equipment: Uncoated cast-iron or steel that will be concealed, or will not be accessible when installations are completed, shall be given one heavy coat of black asphaltum before installation.

3.7 OPERATING INSTRUCTIONS: Contractor to provide services of an experienced Engineer to instruct Owner in operation of entire installation. Instructional period shall be during normal work day hours. This instruction period may be simultaneous with compliance tests.

3.8 COMPLIANCE TESTS: Conduct such tests of all portions of installation as may be necessary to ensure full compliance with the Drawings and Specifications. Tests shall be made in the presence of the Owner. Costs of test shall be borne by Contractor and Contractor shall provide all instruments, equipment, labor and materials to complete all the tests. Tests may be required on any item between installation of Work and the end of 1 year warranty period. Should these tests develop any defective materials, poor workmanship or variance with requirements of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.

A. All Feeders: Measure and record as follows:
1. 600 volt conductors shall be tested with 500 volt megger to ground on each phase. megger to be on test for one minute before any readings are taken. The minimum values on all feeders shall be 100,000 OHMS.
2. Copies of the certified test readings shall be transmitted to Owner.

3.9 SYSTEM ACCEPTANCE:

A. Final Review: The Contractor shall request a final review prior to system acceptance after:
1. Completion of installation of all systems required under the Contract Documents.
2. Submission and acceptance of operating and maintenance data.
3. Completion of identification program.

B. Acceptance: Is contingent on:
1. Completion of final review and correction of all deficiencies.
2. Satisfactory completion of acceptance tests demonstrating compliance with all performance and technical requirements of Contract Documents.
3. Satisfactory completion of training program and submission of manuals and Drawings required by Contract Documents.

3.10 PRELIMINARY OPERATION: The Owner reserves the right to operate portions of the electrical system on a preliminary basis without voiding the warranty or relieving the Contractor of his

responsibilities.

3.11 CLEAN-UP: Conform to the Submittal Section. Upon completion and at other times during progress or Work, when required, remove all surplus materials, rubbish, and debris resulting from Work of Division 26.

END OF SECTION 26 00 50

SECTION 26 00 60 MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner and Architect/Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect and make safe all electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Owner's representative.

C. Provide temporary wiring and connections to maintain required existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area when outage affects business operation.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and

local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service and new system is accepted. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Security System: Maintain existing system in service until new system is complete and ready for service and new system is accepted. Disable system only to make switchovers and connections. Obtain permission from the Owner and security company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply and re-label devices as spares.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Disconnect and remove abandoned conduit.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, and in compliance with new project specifications.

M. Modify existing as-built drawings to note changes.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.5 INSTALLATION

A. Install relocated materials and as required by this section and Owner's representative.

END OF SECTION 26 00 60

SECTION 26 01 11 – CONDUITS

PART 1 GENERAL

A. The general provisions apply to this section.

1.1 WORK INCLUDED

A. Conduits; including:
1. Rigid steel conduit.
2. Intermediate metal conduit (IMC).
3. Electrical metallic tubing (EMT).
4. Rigid aluminum conduit.
5. Polyvinyl chloride conduit (PVC).
6. Flexible metal conduit.
7. Liquid-tight flexible metal conduit.

1.2 DEFINITION

A. Conduit: This term shall be construed to mean conduit and conduit fittings; and tubing and tubing fittings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Support material: Section 260190.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION - ALL MATERIALS SHALL BE MANUFACTURED IN THE USA.

A. Rigid Steel Conduit: Hot-dipped galvanized or sherardized including the threads, manufactured in accordance with ANSI C80.1 and UL6.
1. Threaded, hot-dipped galvanized or sherardized fittings manufactured in accordance with ANSI C80.4.

B. Intermediate Metal Conduit: Hot-dipped galvanized including the threads, manufactured in accordance with UL 1242.

C. Electrical Metallic Tubing: Manufactured in accordance with ANSI C80.3 and UL 797.
1. Provide compression fittings in walls, ceiling spaces or exposed construction areas.
2. Provide compression (water tight) fittings in damp areas or areas exposed to weather.

D. Rigid Aluminum Conduit: Manufactured in accordance with ANSI C80.5.
1. Threaded fittings, manufactured in accordance with ANSI C80.4.

E. Polyvinyl Chloride Conduit: Schedule 40 and schedule 80, manufactured in accordance with ANSI C33.91, UL 651, and Nema TC-2.
1. Cemented type fittings of the same manufacturer as the conduit.

F. Polyvinyl Chloride Conduit: Type EB, heavy wall, manufactured in accordance with ANSI C33.91, UL651, and Nema TC-8.
   1. Cemented fittings of the same manufacturer as the conduit.

G. Flexible Metal Conduit: Hot-dipped galvanized steel, manufacturer in accordance with UL 1.
   1. Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes and twist-in connectors for 1/2-inch and 3/4-inch flexible metal conduit.

H. Liquid-Tight Flexible Conduit: Hot-dipped galvanized with liquid-tight vinyl jacket.
   1. Liquid-tight fittings.

PART 3 EXECUTION

3.1 USE

A. EMT for all exposed and concealed work except as indicated in Paragraphs B, C, D, E, F, and G.

B. Rigid steel, IMC, or rigid aluminum conduit in areas where exposed conduit could be subject to physical damage or where conduit is exposed and conductor phase to ground voltage exceeds 300 volts.

C. Rigid aluminum conduit may be used for all feeder runs exposed or concealed in stud walls and spaces above suspended ceilings.

D. PVC Conduit:

1. Schedule 40 for runs below grade in direct contact with earth.

2. Schedule 40 in concrete floors, walls or roofs.

E. Flexible Conduit (steel only permitted):
   1. For connection to equipment subject to vibration, maximum length 18 inches. In wet locations use liquid-tight flexible conduit.
   2. For connection to lighting fixtures above suspended ceilings. Lengths limited to 72 inches.
   3. Install ground conductors in all flexible conduits.

F. Where 3/4-inch conduit runs are concealed in walls or ceilings and these runs are through wood studs and wood joists, flexible steel conduit may be used up to a maximum length of 6'0".

G. All risers shall be PVC coated RGS with bushings or schedule 80 PVC where noted.

H. In concrete or below grade use conduit not smaller than 1 inch. Maximum size in concrete slab: 1 inch. Run larger sizes under slab.

I. Use long sweep elbows with minimum radius 10 times nominal conduit diameter for all telephone and communication runs.

3.2 INSTALLATION

A. Provide conduit support and bracing in accordance with the latest published SMACNA guidelines.

B. Perform excavating, trenching, backfilling, and compacting as specified in Division 2.

C. Minimum cover for runs below finished grade outside buildings: 24 inches except where noted or required by the serving utility. Minimum cover for conduit in concrete floors, walls or roof: 1/3 thickness of slab. Minimum cover under building slabs is 12-inches.

D. Minimum separation from uninsulated hot water pipes, steam pipes, heater flues or vents: 6 inches. Avoid running conduit directly under water lines.

E. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose.

F. Provide conduit bodies for exposed conduit runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, walls or equipment. Make conduit body covers accessible.

G. Make conduit field cuts square with saw and ream out to full size. Shoulder conduits in couplings.

H. Run a minimum of one 3/4-inch empty conduit for every three single pole spare circuit breakers, spaces or fraction thereof and not less than two 3/4-inch conduits from every flush mounted panel to an accessible space above the ceiling and below the floor.

I. Make conduit projections from covered areas to areas exposed to the weather watertight by proper flashing. Extend flashing a minimum of 6 inches in all directions from conduit.

J. Where conduit is to remain empty, install polypropylene or nylon pull-line 3/16" minimum diameter from end to end with tag at each end designating opposite terminations.

K. Run conduit parallel and at right angle to building lines, when visible in finished construction.

L. Cap conduits indicated to be stubbed-out underground using glued-on PVC caps intended for this purpose.

M. Install a coupling flush with the floor on all conduits stubbed up through floors on grade.

N. Make no bends with a radius less than 12 times the diameter of the cable it contains nor more than 90 degrees. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.

O. Where conduit installed in concrete or masonry extends across building construction joints, provide expansion fittings as manufactured by O.Z.; Crouse-Hinds; Appleton; or equal, with approved ground straps and clamps.

P. Concrete Wall or Slab Penetrations: All core drilling, sleeves, blockouts or other penetrations must be approved by the Structural Engineer prior to installation.
   1. Space sleeves and core drills to insure a minimum dimension of 3 times the nominal trade diameter of the largest adjacent conduit between sleeves or core drills.
   2. Use blockouts for concentrations of conduits in a confined area.

Q. Do not penetrate walls with flexible conduit where subject to physical damage. Use

recessed box with extension ring for transition from interior to exterior of wall.

R. All homeruns shown shall be run to the panel indicated independently of all other homeruns. Provide pull points so as not to exceed total bends of 360 degrees between them unless otherwise indicated.

S. At switchboards, manholes and floor standing distribution panelboards, provide insulated throat bushings or bell ends on all non-metallic conduit entries and bushings on all metallic conduit entries.

T. Provide bushings on all conduit terminations sized 1" and larger.

U. Provide weatherproof boxes and connectors for all exposed parking structure raceways and boxes.

V. Provide bell ends on all conduits into pullboxes and manholes, seal all conduits after conductors are pulled.

W. Cap all unused conduits with end cap. Do not tape.

END OF SECTION 26 01 11

SECTION 26 01 15 – WIREWAYS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Wireways, sheet metal troughs with screw-on removable covers.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hoffman Engineering Co.

B. General Electric Co.

C. Square D Co.

2.2 MATERIAL AND FABRICATION

A. Use sheet steel wireways with screw-on covers and corrosion resistant hardware. For dry locations coat with rust inhibitor and finish with gray baked enamel. For wet locations use hot-dipped galvanized material finished with gray baked enamel, provide gaskets for covers as required. Provide (permanent engraved (3/4" letters) labels on all covers to signify voltage, communications or telephone.

PART 3 EXECUTION

3.1 INSTALLATION

A. Wireways shall be securely fastened to the mounting surface. Use expansion type anchors in concrete. Suspended wireways shall be supported 4 feet on centers.

END OF SECTION 26 01 15

SECTION 26 01 20 – CONDUCTORS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Conductors; for power, lighting, sound, communication and control, including conductors for general wiring, flexible cords and cables, and ground conductors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Conductors for General Wiring: Thermoplastic insulated rated for 600V manufactured in accordance with UL 83.
   1. Provide 3/4 hard drawn copper conductors. Provide solid conductor for #12 AWG and smaller. Provide stranded conductors for #10 AWG and larger.

B. Conductor Connectors for General Wiring:
   1. Sizes No. 14 to No. 8: Splice with insulated spring wire connectors.
      a. Ideal No. 451, 455 and 453.
      b. Minnesota Mining: Types Y, R, G, and B.
      c. Buchanan No. B1, B2 and B4.
   2. Size No. 6 or Larger, Copper: Splice and terminate with compression or pressure type connectors and terminal lugs.

C. Provide connector sealing packs for all area lighting and exterior box splices which require complete protection from dampness and water.
   1. Scotchlok No.'s 3576, 3577 and 3578, by 3M Company.

PART 3 EXECUTION

3.1 USE

A. Conductors for General Wiring:
   1. Minimum 75 degrees C temperature rated insulation on conductors, except use minimum 90 degrees C temperature rated insulation on conductors in conduits exposed on roof, or where required due to ambient temperature.
   2. Stranded conductors at motors and other applications where subject to vibration.
   3. Minimum size conductors for power and lighting #12 AWG, except where noted.
   4. Minimum size conductors for control circuits #14 AWG stranded with THHN/THWN insulation.

B. Use flexible cords and cables for connection of special equipment as indicated. Length not to exceed 72 inches.

C. Ground Conductors:
   1. Provide an insulated green ground conductor for all branch circuit wiring where indicated.
   2. Bare copper conductor may be used.
      a. Install ground conductors in all non-metallic conduits as required by code. Install ground conductors in all motor branch circuits and all feeders. Where ground conductor size is not indicated, provide size as required for an equipment ground conductor by the National Electrical Code.
      b. Install ground conductors in all flexible metal conduits.

3.2 INSPECTION

A. Check conduit system for damage and loose connections, replace damaged sections.

B. Check for caps at conduit openings. Make sure that inside of conduit is free of dirt and moisture.

C. Pull mandrel, one size smaller than the conduit, through entire length of all underground conduits prior to conductor installation.

3.3 INSTALLATION

A. Conductors for General Wiring:
   1. Color code conductors insulation as follows:

CONDUCTOR	SYSTEM 208Y/120	VOLTAGE 480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow

   2. For conductors #6 AWG or larger, permanent plastic colored tape may be used to mark conductor in lieu of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.
      a. Provide color tape on each end and at all terminal points and splices on wire enclosed in conduit.
      b. Provide color tape every 3 feet on wire not enclosed in a listed wireway.
   3. When pulling conductors, do not exceed manufacturer's recommended values.
   4. Use polypropylene or nylon ropes for pulling conductors.

B. Insulate splices with plastic electrical tape: Scotch No. 33+, Tomic No. 1T, or equal.

C. Terminate all control wires with terminal lugs on terminal boards not designed with pressure plates. If splices are needed, use same procedure, installing a terminal board in a junction box for protection.

D. All splices or connections shall be compression type Thomas & Betts or Burndy, no split bolt connections are allowed.

3.4 IDENTIFICATION

A. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices and in pull boxes.

B. Branch Circuits: Identify with the corresponding circuit designation at the over-current device and at all splices and devices.

C. Control Wires: Identify with the indicated number and/or letter designation at all terminal points and connections.

D. Alarm and Detection Wires: Identify with the indicated wire and zone numbers at all connections, terminal points, and coiled conductors within cabinets.

E. Conductors Terminated By Others: Indicate location of opposite end of conductor, i.e., Pull Box-Room 101.

F. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Permasleeve with type written identification.

G. Circuit designation is construed to mean panel designation and circuit number, i.e., LA-13.

END OF SECTION 26 01 20

SECTION 26 01 30 – ELECTRICAL BOXES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Boxes; including:
   1. Outlet boxes.
   2. Pull and junction boxes.
   3. Cabinets.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

B. Support Material: Section 260190.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Outlet Boxes:
   1. Pressed Steel Boxes: Knockout type, hot-dipped or electro-plate galvanized.
   2. Cast Iron Boxes: Hot-dipped or electro-plate galvanized with threaded hubs.
   3. Cast Iron Conduit Bodies: Hot-dipped or electro-plate galvanized with threaded hubs.
   4. Cast copper free aluminum conduit bodies with threaded hubs.
   5. Covers for Pressed Steel Boxes: Hot dipped or electro-plate galvanized.
   6. Outlet boxes manufactured in accordance with UL 514.

B. Pull and Junction Boxes:
   1. Sheet steel, hot-dipped or electro-plate galvanized, or prime coated and a final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.
      a. Where exposed to weather, provide raintight hubs for conduits entering the boxes, top and sides only.
   2. Floor Boxes:
      a. Single gang, similar to Hubbell #B-2536.
      b. Covers:
         1) Combination, similar to Hubbell #S-2525.
         2) Duplex receptacle, similar to Hubbell #S-3925.
      c. Carpet flange, similar to Hubbell #S-3075 thru #S-3079.
      d. Hubs: Provide hubs as required to suit the conduit arrangement.
   3. Pre-Cast Concrete Pull Boxes: As manufactured by Jensen Pre-Cast or Utility Vault and shown on drawings.
   4. High impact resistant PVC boxes: As manufactured by Carlon, Sedco, or R & G Sloan.

C. Cabinets: Sheet metal, prime coat and final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.
   1. Control Cabinet: NEMA 1 enclosure, door with butt hinges and flush handle latches.
      a. Provide with removable steel back panel.

2. Terminal Cabinets: NEMA 1 enclosure, door with concealed hinges and spring catch type flush cylinder locks. Key locks alike, provide two keys with each lock.
3. Provide engraved plastic nameplates with 1/2" minimum height letters indicating designation of control and terminal cabinets as shown on the drawings.
   a. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

PART 3 EXECUTION

3.1 USE

A. Outlet Boxes:
   1. Ceiling Outlet Boxes: Not less than 4" octagonal by 2" deep.
   2. FDD cast iron or cast aluminum device boxes and conduit bodies with metal covers for exposed conduit installation. Provide gasket for covers in wet areas.
   3. Intercom, Microphone and TV Outlet Boxes: Not less than 4-11/16" square x 2-1/8" deep.
   4. Provide floor boxes with quantity of gangs as required for power, communication or control as indicated. Use boxes with barriers where required. Provide carpet flanges in carpeted areas.

B. Pull and Junction Boxes:
   1. Use sheet steel boxes NEMA Type 1 for indoor and NEMA Type 3R for outdoor installation, except as follows.
   2. Use pre-cast concrete boxes for boxes flush in finish grade where requiring a nominal capacity greater than 144 cubic inches, where located in vehicular traffic areas, or where indicated.
   3. Use polyvinyl chloride (PVC) boxes flush in finish grade when the nominal internal volume is less than or equal to 144 cubic inches or where indicated.
   4. Use cast iron boxes for boxes flush in slab on grade.

3.2 INSTALLATION

A. Provide 3/8" fixture studs in wall bracket and ceiling boxes.

B. Provide covers suitable for the fixtures or devices used.

C. Make outlet box covers flush with finished surfaces.

D. Close unused open knockouts with knockout seals.

E. Provide 1" deep plaster rings on recessed outlet boxes installed in areas where concrete will be exposed after construction is complete.

F. Where boxes are concealed in exposed concrete unit masonry, use square cornered types or boxes fitted with rings of sufficient depth for the box to be recessed completely within cavity of block or tile. Install box to insure that ring fits an opening sawed out of the masonry, so that no mortar is required to fill between ring and construction.

G. Provide a 6" base of compacted crushed rock under pre-cast concrete pull boxes.

H. Adjust floor boxes so they are level with top of finished floors.

I. Provide pull boxes and junction boxes in all branch circuit and feeder runs as indicated. Do not provide pull boxes unless they are indicated or required by the Electrical Code.

3.3 IDENTIFICATION

A. Junction Boxes: Use permanent black marker, 2” high lettering, and on each cover plate indicate the power source and circuits contained within that junction box.

END OF SECTION 26 01 30

SECTION 26 01 33 – TERMINAL CABINETS

PART 1 GENERAL

1.1 DESCRIPTION: Division 1 and Section 260050 apply to this Section. Provide terminal cabinets for signal and communications terminals, complete.

A. Related Work Not In This Section:
1. Outlet, pull, and junction boxes.
2. Panelboards for lighting and power.

PART 2 PRODUCTS

2.1 MATERIALS: Cold rolled sheet steel, with hinged door and cylinder lock keyed to match panelboard cabinets.

2.2 DESIGN: To suit applicable system requirements; surface or flush-mounting as shown; knockouts as required. Design to match panelboard cabinets.

2.3 FABRICATION: One-piece, die-formed or continuously welded, and assembled in factory.

2.4 FINISH: Baked enamel on a suitable primer; color as specified elsewhere, required by standards, or as directs.

2.5 INTERIORS: Provide 5/8" plywood (fire resistant) backing in all signal and communications terminals.

PART 3 EXECUTION

3.1 INSTALLATION: Secure and substantial, cabinets attached to building walls or structure.

3.2 IDENTIFICATION: Provide identification nameplates; of engraved bakelite; riveted or screwed to each cabinet. Take text from Drawings and as approved by Architect.

END OF SECTION 26 01 33

SECTION 26 01 40 – WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wiring devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Identification: Section 260030.

B. Boxes: Section 260130.

1.3 SUBMITTALS

A. In accord with Section 260010

1.4 DEFINITION

A. Wiring devices: This term includes all wall switches, pushbuttons, receptacles, and plates used for general purpose installation.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Wall switches:
1. Quiet toggle type, 20A – 120/277 VAC rated, with terminal screws to take up to No. 10 AWG conductors:

	SPST	**DPST**	**3-WAY**	**SPST KEY SWITCH LOCK**	**4-WAY**
Arrow-Hart	1991-I	1992-I	1993-I	1991-L	1994-I
Bryant	4901-I	4902-I	4903-I	4901-L	4904-I
General Electric	GE5951-2	GE5952-2	GE5953-2	GE5951-OL	GE5954-2
Hubbell	1221-I	1222-I	1223-I	1221-L	1224-I
Pass & Seymour/ Legrand	20AC1-I	20AC2-I	20AC3-I	20AC1-L	20AC4-I

2. Momentary contact type, 20A-120/277V, two-circuit, three-position, center off:

Arrow-Hart	1995-I
Bryant	4921-I
General Electric	GE5935-2
Hubbell	1557-I
Pass & Seymour/Legrand	1250-I

C. Receptacles, caps, and connectors:

1. 15A-125V, NEMA 5-15, parallel slot type with grounding pin:

	DUPLEX	**SINGLE**	**GFI**
Arrow-Hart	5252-I	5261-I	GF5242-I
Bryant	5252-I	5261-I	GFR52FT
General Electric	5252-2	5261-2	TGTR115F
Hubbell	5252-I	5251-I	GF5252-I
Pass & Seymour/Legrand	5252-I	5261-I	1591-SHG

2. 15A-250V, NEMA 6-15, straight blade grounding type:

	RECEPTACLE	**CAP**
Arrow-Hart	5661-I	6666
Bryant	5661-I	5666-N
General Electric	GE4069-2	GED0611
Hubbell	5661-I	5666-C
Pass & Seymour/Legrand	5662-I	5666-X

3. 15A-125V, NEMA L5-15, locking type with ground:

	RECEPTACLE	**CAP**	**CONNECTOR**
Arrow-Hart	4700	4721	4731
Bryant	4700	4721-NSY	4732-NSY
General Electric	GL4700	GLD0511	GLD0513
Hubbell	4700	4720-C	4729-C
Pass & Seymour/Legrand	4700	L515-P	L515-C

4. 20A-125V, NEMA 5-20, straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5361-I	5362-I
Bryant	5361-I	5362-I
General Electric	GE4102-2	GE4108-2
Hubbell	5361-I	5362-I
Pass & Seymour/Legrand	5361-I	5362-I

5. 20A-125V, NEMA L5-20, two-pole, three-wire locking type, with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6200	6202	6204
Bryant	70520-FR	70520-NP	70520-NC
General Electric	GL0520	GLD0521	GLD0523
Hubbell	2310-A	2311	2313
Pass & Seymour/Legrand	L520-R	L520-P	L520-C

6. 20A-125V, NEMA 5-20, two-pole, three-wire, straight blade isolated grounding type receptacle:

	DUPLEX	SINGLE
Arrow-Hart	IG5362	IG5361
Bryant	5362-IG	5361-IG
General Electric	GE8300-IG	GE8310-IG
Hubbell	IG-5362	IG-5361
Pass & Seymour/Legrand	IG-6300	IG-5361

7. 20A-125 VAC, two-pole, three-wire, NEMA 5-20, straight blade, specification grade, ivory color, ground fault circuit interrupter receptacle (GFCI), rated for feed-through wiring, with LED indicator light:

	GFCI RECEPTACLE
Hubbell	GF-5362I
Pass & Seymour	2091-S-L-I
Leviton	6898-I

8. 20A-125/250V, NEMA 14-20, three-pole, four-wire straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5759	5757
Bryant	-	-
General Electric	GE1420	GED1421
Hubbell	8410	8411-C
Pass & Seymour/Legrand	L1420-R	L1420-P

9. 20A-250V, NEMA 6-20, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	8510	6866	6869
Bryant	5461	5466N	5469N
General Electric	GE4182	GED0621	GED0623
Hubbell	5461	HBL5466-C	HBL5469-C
Pass & Seymour/Legrand	5871	5466-X	5469-X

10. 20A-120/208V, NEMA L21-20, four-pole, five-wire locking and grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6470	6472	6474
Bryant	72120-FR	72120-NP	72120-NC
General Electric	GL2120	GLD2121	GLD2123
Hubbell	2510A	2511	2513
Pass & Seymour/Legrand	L2120R	L2120P	L2120C

11. 20A-250V, NEMA L6-20, two-pole, three-wire locking and grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6210	6212	6214
Bryant	70620FR	70620NP	70620NC
General Electric	GL0620	GLD0621	GLD0623
Hubbell	2320A	2321	2323
Pass & Seymour/Legrand	L620-R	L620-P	L620-C

12. 20A-480V, NEMA L16-20, three-pole, four-wire locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6430	6432	6434
Bryant	71620-FR	71620-NP	71620-NC
General Electric	GL1620	GLD1621	GLD1623
Hubbell	2430A	2431	2433
Pass & Seymour/Legrand	L1620-R	L1620-P	L1620-C

13. 30A-125V, NEMA 5-30, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5716N	5717N	6716N
Bryant	9530-FR	9630-RP	-
General Electric	GE4138-3	GED0531	GED0533
Hubbell	9308	9309	-
Pass & Seymour/Legrand	3802	5921	-

14. 30A-125V, NEMA L5-30, two-pole, three-wire grounding and locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6330	6332	6334
Bryant	70530-FR	70530-NP	70530-NC
General Electric	GL0530	GLD0531	GLD0533
Hubbell	2610	2611	2613
Pass & Seymour/Legrand	L530-R	L530-P	L530-C

15. 30A-125/250V, NEMA 14-30, three-pole, four-wire straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5744N	5746N
Bryant	9430-FR	5746
General Electric	GE4191-3	GED1431
Hubbell	9430	9431
Pass & Seymour/Legrand	5740	5741-AN

16. 30A-125/250V, NEMA L14-30, three-pole, four-wire grounding and locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6510	6512	6514
Bryant	71430-FR	71430-NP	71430-NC
General Electric	GL1430	GLD1431	GLD1433
Hubbell	2710-A	2711	2713
Pass & Seymour/Legrand	L1430-R	L1430-P	L1430-C

17. 30A-250V, NEMA L6-30, two-pole, three-wire locking blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6340	6342	6344
Bryant	70630-FR	70630-NP	70630-NC
General Electric	GL0630	GLD0631	GLD0633
Hubbell	2620-A	2621	2623
Pass & Seymour/Legrand	L630-R	L630-P	L630-C

18. 30A-250V, NEMA 6-30, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5700N	5701N	6700N
Bryant	9630-FR	9630-ANP	-
General Electric	GE4139-3	GE4328-9	GE4373-9
Hubbell	9330	9331	-
Pass & Seymour/Legrand	3801	5931	-

19. 50A-208V (50A-600V), three-pole, four-wire locking type with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	3769	3765	3764
Bryant	3769	3765	3764
General Electric	LD3769	LD3765	LD3764
Hubbell	3769	3765-C	3764-C
Pass & Seymour/Legrand	3769	3765	3764

20. 50A-125/250V, NEMA 15-50, three-pole, four-wire grounding straight blade type:

	RECEPTACLE	CAP
Arrow-Hart	5754N	5745N
Bryant	9450-FR	5745
General Electric	GE4181-3	GE4180-3
Hubbell	9450	9451
Pass & Seymour/Legrand	5750	5751-AN

21. 50A-125/250V, three-pole, four-wire grounding locking blade type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	CS6369	CS6365	CS6364
Bryant	CS6369	CS6365	CS6364
General Electric	-	-	-
Hubbell	CS6369	CS6365	CS6364
Pass & Seymour/Legrand	-	-	-

22. 50A-250V, NEMA 6-50, two-pole, three-wire grounding straight blade type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5709N	5710N	6709N
Bryant	9650-FR	9650-RP	-
General Electric	GE4141-3	GED0651	GED0653
Hubbell	9367	9368	-
Pass & Seymour/Legrand	3804	3869	-

23. 60A-120/208V, three-phase, 60 Hz, five-pole, five-wire, watertight, with threaded cap:

	BOX	ANGLE ADAPTER	RECEPTACLE BODY	COMPLETE ASSEMBLY
Hubbell	26401	26404	26520	-
Crouse-Hinds	-	-	-	Area-6575
Russell Stoll	-	-	-	DS6516-FRAB-

24. 60A-480V, NEMA L16-20, three-pole, four-wire locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	-	-	-
Bryant	-	-	-
General Electric	-	-	-
Hubbell	HBL 26410	HBL 26402	HBL 26418
Pass & Seymour/Legrand	-	-	-

D. Safety receptacle: 15A-125V, NEMA 5-15, straight blade grounding safety receptacle, Hubbell No. SG-62H-1.

F. Device cover plates:
1. Interior plates: Specification grade plastic, 0.1 in. thick, ivory in color, UL listed.
   a. Plates in kitchens and restrooms to be polished stainless steel, 0.040 in. thick except in kitchens use double lift lid weatherproof gasketed plates for convenience receptacles.
   b. MATV plate: RMS No. CA-4028.
2. Exterior plates: Choose type of exterior cover plate in accord with the device location and/or manner in which device will be used. Device cover plates shall be die-cast aluminum with hinged cover, rated for respective type of use specified below, or as indicated on Drawings.
   a. Outlet box weatherproof hoods: NEMA 3R rating, gasketed, for unattended use with cover closed, padlockable latching cover to meet OSHA lockout/tagout requirements, large cord opening and UL listed. As manufactured by Hubbell, Intermatic or Leviton.
   b. Low profile weatherproof cover: Gasketed, approved for use with cover open, self-closing hinged covers (two independent self-closing lids for duplex receptacles which are horizontally mounted), UL listed. As manufactured by Hubbell, Leviton or Pass & Seymour.
   c. Communication outlet weatherproof hoods: NEMA 3R rating for unattended use with cover closed, two-cord openings and UL listed. As manufactured by Red Dot.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mount switches and receptacles in vertical position in building interiors.

B. Mount receptacles with weatherproof plates in horizontal position.

C. Install receptacles mounted vertically so that the ground contact falls on the top position, and horizontally-mounted receptacles with neutral pole in top position.

D. Use plastic blank plates on J-boxes in public areas.

E. Use mechanical type door switches for load control.

F. Install receptacles for plug in lighting fixtures within 36 in. of fixture location.

G. Use safety type receptacles with low profile weatherproof metal covers for all convenience outlets in guest accessible areas (i.e., queue lines, waiting areas, etc.).

H. All GFI type exterior receptacles shall be provided with weatherproof metal hoods.

I. GFI type receptacles shall not be fed-through wire.

END OF SECTION 26 01 40

SECTION 26 01 42 – NAMEPLATES AND WARNING SIGNS

PART 1 GENERAL

NOT USED.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Nameplate shall be plastic laminate with 3/4" high letters in white on black background screwed onto equipment designations shall clearly state:
   1. Equipment Enclosure Nameplates.
      a. Manufacturer's nameplate including equipment design rating of current, voltage, KVA, HP, bus bracing rating, or as applicable.
      b. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for KVA, amperes, HP and RPM as applicable. Designation data per drawings or to be supplied with shop drawings approval.

   2. Device nameplates: Device usage, purpose, or circuit number; manufacturer and electrical characteristic ratings including the following:
      a. Circuit Breakers: Voltage, continuous current, maximum interrupting current and trip current.
      b. Switches: Voltage, continuous current, horsepower or maximum current switching. If fused, include nameplate stating "Fuses must be replaced with current limiting type of identical characteristics."
      c. Contactors: Voltage, continuous current, horsepower or interrupting current, and whether "mechanically-held" or "electrically-held".
      d. Motors: Rated voltage, full load amperes, frequency, phases, speed, horsepower, code letter rating, time rating, type of winding, class and temperature.
      e. Controllers: Voltage, current, horsepower and trip setting of motor running over current protection.

2.2 WARNING SIGNS

A. Warning signs shall be minimum 18 gauge steel, white porcelain enamel finish with red lettering. Lettering to read "DANGER - HIGH VOLTAGE" in 1" letters. Warning signs to be included on door or immediately above door of all electrical equipment rooms, vaults or closets containing equipment rooms, vaults or closets containing equipment energized above 150 volts to ground, except where such spaces are accessible from public areas.

2.3 WARNING SIGN DESIGNATION

A. Warning designation in 1" red letters shall be painted by stencil or pre-printed adhesive on each pull box, cabinet or 1-foot length of exposed conduit stating "DANGER" and giving voltage of enclosed conductors such as "DANGER - 480 VOLTS", for all systems over 150 volts to ground.

PART 3 EXECUTION

3.1 INSTALLATION

A. Nameplates shall be mounted by self-tapping or threaded screws and bolts or by rivets.

B. Signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

END OF SECTION 26 01 42

SECTION 26 01 63 – DISTRIBUTION PANELBOARDS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Distribution panelboards.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

B. Overcurrent Protective Devices: Section 260180.

C. Disconnects: Section 260170.

D. Control Devices: Section 264901.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide distribution panelboards with molded case breakers or fused switches for mains and feeders as indicated. All equipment shall be listed to meet or exceed the available short circuit current.

B. Provide full length copper bussing including areas indicated as space only.

C. Provide full size neutral bus where neutral bus is indicated.

D. Provide copper ground bus adequate for number of grounded circuits.

E. Circuit Breaker Type: Square-D Co. I-Line, with alternate bid for General Electric type AV Line.

F. All circuit breakers shall be capable of being locked in the off position.

PART 3 EXECUTION

3.1 INSTALLATION

A. Secure panelboards to structures to withstand wire pulling strains.

B. Secure surface mounted panelboards to wood studs or channel material spanning metal studs.

C. Do not use toggle bolts to wall mount units.

D. Floor mounted units shall be on 4-inch concrete housekeeping pads.

E. Secure to structure per seismic requirements.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all distribution panelboards shown on the single line diagram.

B. Provide panelboard and source feed designation on nameplates with minimum 3/8" lettering for the panel name and 3/4" height lettering for the source feed designation.

EXAMPLE: DLA

FED FROM: T-2

C. Provide engraved plastic nameplates with 1/4" minimum height letters at all branch overcurrent devices indicating the circuit designating and the load served.

D. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION 26 01 63

SECTION 26 01 64 BRANCH CIRCUIT PANELBOARDS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Branch circuit panelboards.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

B. Overcurrent Protective Devices: Section 260180.

C. Control Devices: Section 264901.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide factory assembled, enclosed panelboards in dead front cabinets, with doors, surface mounted or recessed as indicated, not less than 20" wide and 5-3/4" deep. Height will depend on the number of breakers and spaces.

B. Where a control compartment is indicated, provide an integral compartment with a separate hinged lockable door held with captive screws. Identify all internal control wiring with manufacturers wire numbering or control wire numbering when indicated, at all terminal points and connections.

C. Provide feeder terminal lugs for both main lugs only and main breakers rated for use with copper conductors.

D. Provide full length copper bussing including areas indicated as space only.

E. Provide full size neutral bus where neutral bus is indicated. Provide equipment ground bus and bolt-on circuit breakers.

F. Key all door locks alike.

G. 120/208V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NQOD or Powerlink G3 NF with programmable module where designated, alternate bid for General Electric type AQ.

H. 277/480V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NF, alternate bid for General Electric type CCB.

I. All equipment shall be listed to meet or exceed the available fault current by 10%.

J. Doors shall be hinged.

K. All placards are welded steel type.

PART 3 EXECUTION

3.1 INSTALLATION

A. Secure panelboards to building structure to withstand wire pulling strains.

B. Secure surface mounted panelboards to wood studs or channel material spanning metal studs.

C. Do not use toggle bolts.

D. Contractor shall program lighting control Powerlink panelboard per owner's requirements.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all branch circuit panelboards shown on the single line diagram.

B. Provide panelboard and source feed designation on nameplates with 3/8" minimum height lettering for the panel name and 1/4" height lettering for the source feed designation.

EXAMPLE: LA

FED FROM: DLA

C. Secure nameplates with at least two spaces or rivets. Cementing and adhesive installation not acceptable.

D. Provide a typewritten directory for each branch circuit panelboard, showing each circuits and its use. Provide metal directory frame with plastic window.

END OF SECTION 26 01 64

SECTION 26 01 70 DISCONNECTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Disconnects: Switches, fused or unfused.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260010.

B. Fuses: Section 260180.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D Company

B. General Electric

2.2 MATERIAL AND FABRICATION

A. Provide heavy duty type, quick-make, quick-break disconnects with cover interlocks.

B. Provide NEMA Type 1 enclosure for dry locations, provide the proper enclosure for other locations as indicated.

C. Provide motor rated toggle switches where indicated.

D. Provide fused disconnect for elevator drive motors.

E. Provide rejection clips on disconnects where rejection type fuses are to be installed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Securely fasten disconnects to structure to withstand wire pulling strains.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on individually mounted disconnects with minimum 1/4" height letters indicating the load served and the source feed designation.

EXAMPLE: LOAD: A/C-1

FED FROM: DHA-1

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION 26 01 70

SECTION 26 01 90 SUPPORT DEVICES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Support devices for conduit, boxes, lighting fixtures and equipment.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hangers, Straps and Beam Clamps:
1. Efcor.
2. Raco, Inc.
3. Steel City.
4. O.Z./Gedney Co.
5. Caddy Fastening System by ERICO Products Inc.

B. Channels and Fittings:
1. Kindorf.
2. Unistrut Corp.

C. Anchors:
1. Acherman-Johnson Corp.
2. Phillips Drill Co.
3. Rawl Products Co.

2.2 MATERIAL AND FABRICATION

A. Hangers: Steel cadmium plated.

B. Straps: One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.

C. Beam Clamps: Malleable iron, hot-dipped galvanized or cadmium plated.

D. Channels and Fittings:
1. Channels: Hot-dipped galvanized.
2. Fittings: Galvanized.

E. Anchors: Self drilling and expansion bolt types. No wood or fiber plugs or concrete nails are acceptable.

PART 3 EXECUTION

3.1 USE

A. Use one-hole or two-hole straps for single conduit runs on walls or ceilings.

B. Use hangers with solid steel rods for hanging single conduits.

C. Use formed channel trapezes for groups of two or more conduits.

D. To fasten boxes and supports to:
   1. Wood: Use wood screws or screw type nails of equal holding power.
   2. Brick and Concrete: Use bolts and expansion shields.
   3. Hollow Masonry Units: Use toggle bolts.

E. Support sheet metal boxes from building structure directly or by bar hangers.

F. Do not penetrate reinforced concrete beams with fastenings more than 1-1/2" or reinforced concrete joints with more than 3/4" fastenings to prevent contact with reinforcing steel.

END OF SECTION 26 01 90

SECTION 26 05 85 HORIZONTAL BORING SYSTEM

PART 1 GENERAL

1.1 GENERAL

A. The general contract provisions of Division 1 takes precedence over this section in case of conflict.

1.2 WORK INCLUDED

A. Horizontal boring

B. Installation of conduit systems

C. Coring into existing structures

D. Proofing conduit systems

1.3 RELATED WORK ELSEWHERE

A. Conduits 260111

B. Manholes/pull boxes

PART 2 PRODUCTS

2.1 MATERIALS AND METHODS - Contractor shall bore and install multiple 2" HDPE schedule 40 conduits as noted on plans with a Pit Launched horizontal directional drill machine. The drill machine shall contain a minimum of 27,000 lbs of push/pull and 4,000 lbs of rotary twist. The drill shall be a rack & pinion design drilling with 10 foot drill rods. The drill will be staged in the bore pit with pilot bit surveyed to centerline of the pipe to be installed.

2.2 Contractor shall be responsible for pit digging & excavation per OSHA & equipment requirements. All pit locations shall be coordinated with the owner's representative. Pits shall be returned to original conditions after boring site construction & operation is completed. The tracking system will be DigiTrak of Radio detection with a depth Sone (Locating Transmitter) good to 25' deep with a remote transmitter sending readings back to the Driller or a similar boring machine. The remote transmitter shall be located on the drill allowing the Driller to read the same information the Locator is reading. The Sone in calibrated in the Sone housing to allow the Locator and Driller to read the clock, pitch and depth. Steering adjustment shall be made at every 10 feet. The pilot hole shall be approximately 4" diameter and the final hole will be approximately 12" to 20" diameter. The pilot shall be shot making steering adjustments to maintain a proper bore path and minimize the number of bends or radius put on the pipe. After the pilot is out a reamer or hole opener shall be places on the drill rod to cut the bore hole. This process may be done in multiple steps, first cutting with an 8 inch reamer and then cutting with a 12 inch reamer. The final stage is pulling the pipe into the bore hole. The Bentonite mud used drilling the bore hole fills the annular space around the PVC/HDPE conduit installed. Contractor to provide in Autocad 2007 format or newer the as built plans accurate within 1 foot in each direction x, y and z.

2.3 A 300 gallon drilling fluid (Mud-Bentonite) mixing system shall be used with a minimum 35 gallon per minute pump to facilitate the drill fluids to the drill. Bentonite shall be used to aid in the cutting

of the spoils, help float the spoils out of the cut bore hole, seal the bore hole and facilitate the installation of the pipe. Viscosity shall be adjusted to soil conditions, but shall not exceed a viscosity of 80. Mud containment will be in entry and exit pits. The mud will be pumped to a vacuum truck and then can be removed from site for proper disposal. Contractor to provide fencing and pit covers during construction for pedestrian traffic.

2.4 RECOMMENDED EQUIPMENT SPECIFICATIONS

2.5 PIT LAUNCHED HORIZONTAL DIRECTIONAL DRILL:

A. Make: Malcolm/IVE/Vermeer/Ditch Witch

B. Design: Pit launched rail surveyed to grade

C. Power: 27,000 push/pull – 4,000 rotary twist

D. Length: 10 feet

E. Width: 4.5 feet

F. Drill Rod: 10 feet long with 2.6 inch diameter

G. Pilot Cutting Bit: 4” Jetting eagle claw

H. Reamers: Sabertooth style/Ripper packer (6” to 15” may be required)

I. Pit Diameter: Minimum 20 feet long / 7 feet wide/ 14” to 24” below centerline

2.6 WALK OVER LOCATOR:

A. Type: Radio Detection or Digitrak

B. Sone Transmitter: Minimum 50 deep

C. Grade Readings: .5%

D. Depth Readings: 5% of true depth

E. Remote Box at Drill: Required

2.7 BENTONITE MUD MIXING SYSTEM

A. Gallon: Minimum 250 gallon tank

B. Pump: 35 gallons per minute

2.8 VACUUM SYSTEM

A. Vacuum: Minimum 500 gallon

PART 3 EXECUTION

3.1 Contractor shall visit site and familiarize himself with all existing conditions.

3.2 Contractor shall at bid time, locate all pits for launching boring operations and submit with the bid form, size & locations of all pits.

3.3 Contractor shall provide 6 foot high temporary fencing around any pits per OSHA requirements during boring periods and until pit is filled.

3.4 Contractor shall provide a 3/16”metered pull string in all conduits.

3.5 Contractor shall provide documentation to insure all conduit systems are clean and usable. Contractor shall clean interiors of all conduits and pull a mandrel plug one size smaller than the conduit to proof the installation.

3.6 Contractor to provide conduit plugs on each conduit end. Pull string to connect to plug with each end uniquely labeled as to source & destination.

3.7 Contractor shall extend conduit system into structures unless noted to be stubbed out. Stubbed out conduits shall be capped.

3.8 Contractor to install locator tape in all bored conduit systems.

3.9 Contractor to coordinate all stub up and pit locations with owner’s representative.

END OF SECTION 26 05 85

SECTION 26 24 50 GROUNDING

PART 1 GENERAL

1.1 REFERENCES

A. N.E.C.: Article 250 "Grounding".

B. Underwriter's Laboratories (U.L.). Standard A67 - "Grounding and Bonding Equipment". STD 869 - Grounding and Bonding.

C. ITEE - Standards 142 and 241.

1.2 DESCRIPTION OF SYSTEM:

A. A permanent grounding system with methods and materials in accordance with applicable Codes and Standards, able to conduct ground fault currents to the grounded neutral of electrical distribution systems, and limit potential differences between grounding conductors, raceways and enclosures.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on grounding systems and accessories.

B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, ground rods, and plate electrodes.

1.4 QUALITY ASSURANCE:

A. Installer qualifies with at least 3 years of successful installation experience on projects with electrical grounding experience similar to that required for project.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Handle electrical grounding accessories and components carefully to avoid damage. Store in location that will protect from dirt and weather.

PART 2 PRODUCTS

2.1 GROUND RODS:

A. Copper clad steel, unless indicated otherwise. Minimum dimension of 5/8" diameter by 8' long or larger if indicated and sectional rods with couplings where lengths exceeding 12' are specified or indicated, or where added driving depth is required to achieve a specified minimum resistance.

2.2 GROUNDING ELECTRODE:

A. Bare stranded copper, 3/0 AWG unless indicated otherwise, for installation in soil or embedded in concrete and cable with type TW insulation when installed in raceway. Install without splice from connection to connection.

2.3 GROUNDING CONDUCTORS:

A. Type TW insulation, unless specified or indicated otherwise with a continuous green outer insulating jacket for size #6 AWG and smaller and with green tape banding for #4 AWG and larger, marked at each access point (e.g.: Junction boxes, Enclosures).

2.4 CLAMPS AND PRESSURE CONNECTORS:

A. Cast copper, copper alloy, or bronze alloy suitable for use with aluminum and copper. Double bolt type with formed shoe and "U" cable clamp for connection to pipe or conduit; Single bolt type with cable shoe and "U" clamp for connections to flat bar or metal; and double bolt, parallel conductor split clamp type for cable to cable connections.

2.5 WELDED CONNECTIONS:

A. Exothermic process (Cadweld or Thermoweld).

2.6 EQUIPMENT ROOM GROUND TERMINAL BAR:

A. Copper 1/4" X 2-1/2" X 24", unless otherwise indicated. Two rows of holes on 1-1/2" centers for 1/2" bolt, to receive cables from two directions.

PART 3 EXECUTION

3.1 GENERAL:

A. Ground conductive raceways, cable trays and enclosures for electrical systems wiring. Make ground circuits complete to form permanent conductive paths. Solidly ground each low voltage electrical system unless indicated or specified as ungrounded, or grounded through an impedance of a specified value. Provide bare conductors when in open air or soil and provide 600 volt, green, insulated conductors when in raceway.

3.2 MAIN GROUNDING JUMPER:

A. Install a main grounding jumper between the system neutral and the enclosure ground bus (or directly to enclosure where ground bus is not present) at each location where system grounding is required. Main grounding jumper:
   1. Formed bus in switchboards and panelboards.
   2. Formed bus or copper cable in transformers not coupled in unitized assembly with distribution equipment.

3.3 GROUND CONNECTIONS:

A. Make grounding electrode connections electrically ahead of any overcurrent or disconnect device or tap connection such that disconnection of neutral load conductors does not interfere with or remove the system ground connection. Use separate lugs on the transformer neutral terminals for neutral and main grounding jumpers when cable is used for transformer connections.

3.4 SEPARATELY DERIVED SYSTEMS:

A. For each separately derived system, grounded or ungrounded, install a grounding electrode conductor between each system enclosure ground bus (or bolted connection to enclosure where ground bus is not present) and a cold water pipe or building structural steel of one (1) inch size or larger near the separately derived system ground connection. Make connections to water pipes or steel accessible for easy inspection. Provide a separate ground conductor for each audio, video, isolated panels and UPS as noted on the plans.

3.5 SERVICE GROUND:

A. For each low voltage service, install a grounding electrode conductor between the system enclosure ground bus and the water service entrance to the building and install bonding jumpers around insulating unions and removable fittings in the water pipe between the grounding electrode conductor connection to the water pipe and the water service entrance.

3.6 GROUNDING ELECTRODE SYSTEM:

A. Install a complete grounding electrode system with interconnecting cables and terminations at the equipment room ground terminal bar. Make connections to the grounding electrode system accessible. Install the following grounding electrode systems:
   1. Metal frame of building.
   2. Grounding electrode encased by at least two inches of concrete, within and near the bottom of the building foundation or footing of the type specified in Part 2 - Products, at least 20 feet in length without splice from connection to connection.
   3. Connection of other metal piping systems as required by National Electrical Code Article 250.
   4. Driven ground rods.
   5. Driven steel piles.
   6. Connection to water service with bonding jumper around water meter.

3.7 GROUNDING ELECTRODE CONDUCTORS:

A. Install grounding electrode conductor in PVC or other non-conductive, non-metallic enclosure where a raceway system is indicated or necessary for conductor installation. Install grounding electrode conductors without splice from the enclosure ground bus to the connection at the grounding electrode system.

3.8 GROUND RODS:

A. Install a vertical position, full length below grade unless specified otherwise, and with conductor and top of rod 6" minimum below grade. Provide exotheric welds at all connections.

3.9 EQUIPMENT ROOM GROUND TERMINAL BAR:

A. Install in equipment rooms where indicated. Mount bar by anchors and bolts using 1-1/2" long segments of 1/2" rigid conduit as spacer between bar and wall. Use a minimum of two supports, 18" on center. Connect grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar. Label permanently all ground conductors as to destination location, e.g. TR1, panel IPS, etcetera.

3.10 EQUIPMENT GROUND:

A. Form the equipment ground circuits with rigid metallic raceways (e.g., EMT, rigid steel conduit) unless indicated otherwise. Make all threaded coupling connections wrench tight. Install bonding jumpers for continuity around fittings and terminations where the conductive raceway is made non-continuous. Where indicated or specified, install ground conductors in raceways to augment the circuits formed by the metallic raceway system. Bond the conductors to boxes or enclosures in which access is possible. Size conductors as specified, indicated, or required by code, whichever is larger. Install grounding bushings and bonding jumpers to enclosures or ground bussing for the following: Service entrance feeder; each location where multiple ring knockouts are damaged during conduit installation; each location where conduits are stubbed up into floor mounted and each conduit termination at a painted enclosure where paint is not removed before installation of raceway.

3.11 FLEXIBLE RACEWAY GROUNDING:

A. Install a ground conductor inside all flexible raceways (e.g., Flexible steel, liquid tight) regardless of length. Bond the conductor to the enclosure or ground bus in the nearest box or access on either side of the flexible section. Size conductor as specified, indicated, or required by code, whichever is larger.

3.12 NON-CONDUCTIVE RACEWAY:

A. Install a ground conductor in raceways of non-conductive materials. Bond conductor to conductive enclosures in which access is possible. Bond non-current carrying conductive equipment contained in a non-conductive enclosure. Install insulated or bare conductors, sized as specified, indicated, or required by code, whichever is larger.

3.13 SECTIONAL RACEWAY:

A. Install a ground conductor in sectional raceways with removable covers for access (e.g., Plug-in strips, surface raceway systems, and wireways) unless specified otherwise. Size conductor in accordance with the N.E.C. for the largest phase conductor size installed in raceway, or as indicated. Bond sections of the raceway to the ground conductor. Connect receptacle ground terminals in the raceway to the ground conductor, and make other ground connections indicated on the drawings.

3.14 CABLE SUPPORT SYSTEMS:

A. Ground elements of the cable support system to panelboards, cabinets and switchboards from which their circuits originate. Install a ground conductor sized as required by code, as indicated, or #12 AWG, whichever is larger.

3.15 MULTI-CONDUCTOR CABLE, METALLIC SHEATH:

A. Use multi-conductor cable with metallic sheath or armor approved for use as ground circuit conductor or install ground conductor(s). Size ground circuit conductor as required by code, as specified, or as indicated on the drawings, whichever is larger. Terminating devices for cable using the sheath or armor as the ground circuit conductor shall be approved for use as the connecting device between the cable and the enclosure. Terminate internal ground circuit conductors by lug to the interior of the enclosure or to the contained ground bus where present. Use bare or clearly identified internal grounding conductors.

3.16 MULTI-CONDUCTOR CABLE, NON-METALLIC SHEATHED:

A. Use only non-metallic sheathed multi-conductor cables having a ground circuit conductor enclosed in the sheath the same size as the ungrounded conductors. Use bare or clearly identified internal grounding conductors. Terminate ground circuit conductor by lug to the enclosure ground bus where present or to the interior of the enclosure.

3.17 GROUND CONDUCTOR BONDING:

A. Bond grounding conductors to boxes or enclosures at each access point. Do not use building steel as equipment grounding path. Use welded ground connections, at least where such are buried in soil, installed below slabs on grade, or embedded in concrete.

END OF SECTION 26 24 50

SECTION 26 47 21 FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. This specification document provides the requirements for the Fire Alarm Systems throughout the facility. These systems shall include, but not be limited to, system terminal cabinets, signal power boosters, backboards, terminal strips, devices with termination, wire/cabling, testing and verification and other relevant components. The contractor shall include all costs for devices, wire, cable, panels, installation labor, tests, approvals and as-built documentation. Additionally, the contractor will be required to provide the necessary interfaces (control modules, etc.) to the monitoring system in which audio is incorporated. All conduits for the fire alarm systems and associated wiring shall be included. The fire alarm contractor shall provide “shop” drawing layouts to owner showing device locations mounting heights and conduit size requirements.

1.2 WORK INCLUDED

A. General Requirements:
   1. The contractor shall furnish and install a modified addressable fire alarm system comprising of fire alarm panels, signal booster panels, Manual Pull Stations, Smoke Detectors, Heat Detectors, system alarm connections, connection to building water flow, tamper and post indicator valves, Alarms, Speakers, Alarm Strobes, Alarm Speaker/Strobes as required by code and as specified herein.
   2. Labeling: All system equipment shall be labeled with the manufacturer's name and logotype to assure the integrity of the complete system.
   3. Contractor shall provide a set of working drawings showing all devices, conduit routing, equipment types and selections, back boxes battery calculation and voltage drop calculations.

1.3 RELATED WORK DOCUMENTS

A. Submittals.

B. Coordination

C. Electrical General Requirements

D. Electrical Raceway

E. Electrical Conduit

F. Electrical Outlet and Junction Boxes

G. Electrical Interior Pull boxes and wireways

H. Electrical Grounding systems

I. Fire Alarm Audio Evacuation Systems

J. Mechanical Plans (connections to heating and air conditioning units)

K. Plumbing Plans (sprinkler flow, tamper and Post Indicator Valve locations)

L. Systems Plans (monitoring systems)

M. Electrical Plans

1.4 DESCRIPTION:

A. This section of the specification includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standards for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

C. The FACP and peripheral initiation devices shall be manufactured 100% by a single manufacturer (or division thereof).

D. The installing company shall employ only factory-trained technicians on site to install and perform the final checkout and to ensure the systems integrity. No “parts & smarts” installation will be acceptable.

1.5 SCOPE

A. A new intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:
1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on a two wire Signaling Line Circuit (SLC).
2. Initiation Device Circuits (IDC) shall be a two-wire circuit.
3. Notification Appliance Circuits (NAC) shall be a two-wire circuit.
4. Digitized electronic signals shall employ check digits or multiple polling.
5. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
7. The Alarm System shall perform the following functions:
   a. Provide automatic fire alarm detection in all building spaces as dictated by local code requirements.
   b. Provide evacuation signals for employees and guests as dictated by local code requirements.
   c. Connect all buildings local fire alarm panels into a seamless network incorporating a central control console located in the administration building and remote console in the guard gatehouse.
   d. Interface with local show control, audio systems, ride control to perform the

required activation or shutdown as dictated by local code requirements.
e. Perform any added functions as specified or required by local codes or AHJ.

C. Basic System Functional Operation:
1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
a. The system alarm LED shall flash.
b. A local piezo electric signal in the control panel shall sound.
c. A backlit 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
d. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
e. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed and the associated system outputs (alarm Notification appliances and/or relays) shall be activated.

1.6 SUBMITTALS

A. General:
1. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Software Modifications:
1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modification on site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

C. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

D. Owner’s designated representative shall approve all equipment submittals.

E. In addition to the General requirements, submit all materials for approval arranged in the same order as Specifications, individually referenced to Specification paragraph and drawing number Submit number required In Division I plus three (3) copies of A4 material and 2 prints plus one reproducible of drawings in A0, minimum. Submit A4 items bound in volumes and A0 drawings in edge bound sets.

F. Progress Schedule: Include duration and milestones for the following:

1. All submittals specified.
2. Shipment to site.
3. Installation.
4. Field testing.
5. Training.
6. First beneficial use date.

G. Manufacturer's Product Data:
   1. List of Materials: For each item, Include:
      a. Manufacturer.
      b. Model number.
      c. Listing: CSFM.
      d. Quantity.
   2. Manufacturer's Product Data: In sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product. Photo copies will not be accepted. Original manufacturer specifications sheets only.

H. Field/Shop Drawings:
   1. Resubmit: for coordination reference complete with corrections from previous submittal:
      a. List of Materials.
      b. Manufacturer's Product Data.
   2. Field (installation) Drawings: Collate in sequence:
      a. Drawing Index/symbol sheet.
      b. Floor plans. At scale of Contract Documents. Show:
         1) Devices with circuit number.
         2) Rough-in.
         3) Mounting height.
         4) Conduit size.
         5) Wire type.
         6) Wire fill.
      c. Sections/Elevations. At scale of Contract Documents.
         1) Mounting location reference.
      d. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:
         1) Refer to “floor plans”.
         2) Architectural features.
         3) Clearances.
      e. System conduit riser drawing, show:
         1) Terminal cabinets.
         2) Coordination with floor plans.
         3) Wire runs not shown on floor plans.
         4) Wire type.
         5) Wire fill.
      f. Mounting details
         1) Stamped and signed by Engineer licensed in jurisdiction for work of this type.
         2) Show loads, strength of connections, etc.
         3) Show calculations - place on drawings or in bound volume for review by authorities having jurisdiction.
         4) Provide details for:
            a) Racks/cabinets/panels
      g. Installation details as required.
         1) Terminal cabinets: terminations.
      h. Wire run sheets (if used) Show:
         1) Wire Number.
         2) Source.

3) Designation
4) Signal type.
5) Wire type.
6) Operating level or voltage (if applies).

3. Shop (Fabrication) Drawings: Collate In sequence:
   a. Drawing Index/symbol sheet (if separate set from Field Drawings).
   b. System functional drawings. Submit separate drawing for each system/subsystem. Show:
      1) Equipment: Function, make, model.
      2) Wire number.
      3) Wire Type.
   c. Fabrication details submit for:
      1) Receptacles.
      2) Panels.
      3) Special mounting provisions.
      4) Legends/engraving details. Half or full size:
         a) Receptacles.
         b) Panels.
         c) Equipment.
4. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
5. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
6. Show annunciator layout, configurations, and terminations.

I. Shop and Field Test Reports:
   1. Schedule: Submit test reports In timely manner relative to Project schedule such that owner may conduct Verification of submitted Test Data at owner’s option, without delay of progress.
      a. Shop test report: Submit prior to shipping completed system to project site.
      b. Field test report: Submit following system completion and prior to and as condition precedent to owner’s acceptance of the Work of this Section.
   2. Test Reports: Include:
      a. Time and date of test.
      b. Personnel conducting test.
      c. Test Object.
      d. Procedure used.
      e. Test equipment, Including serial and date of calibration.
      f. Results of test - numerical or graphical presentation.
   3. Verification of Submitted Test Data: owner may elect to verify some or all test data submitted. Retest In presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this Section. Provide all test equipment.

J. Reference Data for Operation, Maintenance and Repair
   1. In addition to the requirements of Division 1, submit one (1) additional set. Submit in three post binders (not ring binder) with Tabs.
   2. Index.
   3. Systems operating Instructions.
   4. Reduced set of system Record Drawings.
   5. Key schedule.
   6. Maintenance and spare parts schedules.
   7. Shop and Field Test Reports.
   8. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's

original operation, Instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.

K. Record Drawings in AutoCAD R2014 format min.
1. Quantity:
   a. Review sets: as for Shop and Field Drawings.
   b. Record set:
      1) Three (3) blueline.
      2) One CD disk with applicable .DWG files
2. Content: All drawings required under “Field and Shop Drawings”. Show “as Installed” condition.

L. Other than Specified Equipment
1. Equipment other than specified shall be considered for approval provided the following is submitted in writing by the contractor to the Consultant ten (3) days before the bid date:
2. Complete lists, descriptions and drawings of materials to be used.
3. A complete list of current drain requirements during normal supervisory conditions, trouble conditions, and alarm conditions
4. Battery standby calculations showing total standby power needed to meet the system requirements as specified

M. Substituted Equipment:
1. If equipment other than that specified is supplied, it shall be the contractor's obligation to submit the appropriate documentation and allow the specifying Consultant sufficient time to consider the equality of the substituted items.

N. Satisfying the Entire Intent of these Specifications
1. It is the contractor's responsibility to meet the entire intent of these specifications. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the Consultant and owner’s representative.
2. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the contractor.

1.7 GUARANTEE/WARRANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.8 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the submittal, include a quote for a maintenance contract to provide all maintenance, test, and repair described below. Include also a quote of unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor that shall describe the protocol for preventive maintenance. The schedule shall include:
   1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
   2. Each circuit in the fire alarm system shall be tested semiannually.
   3. Each smoke detector shall be tested in accordance with the requirements of CSFM & NFPA Standards.

1.9 POST CONTRACT EXPANSIONS:

A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable control modules equal (list actual quantity of each type).

C. Quotation shall include installation and test labor and labor to reprogram the system for this 10% expansion. If additional FACP hardware would be required, include the material and labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include cost of conventional peripherals or the cost of initiating devices or Notification appliances connected to the addressable monitor/control modules.

E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.10 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.
   1. DSA Requirements
   2. County of Ventura Fire Code
   3. All requirements of the Authority Having Jurisdiction (AHJ).

1.11 APPROVALS

A. The system shall have proper listing and/or approval from internationally recognized agencies.

B. The system shall be listed by the international agencies as suitable for extinguishing release applications.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIAL

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE

A. Conduit:
1. Conduit shall be red & installed in accordance with the DSA & fire marshal requirements.
2. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum and red in color.

B. Wire:
1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with DSA codes and approved by CSFM and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation.
5. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall support up to 1,000 ft. of untwisted, unshielded wire. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.
6. All field wiring shall be completely supervised.
7. The Fire Alarm Control panel shall be capable of T-Tapping two wire type. Signaling

Line Circuits (SLC's) Systems, which do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.

8. All wire/cable used in underground or below grade, applications shall be rated by the manufacturer for the intended use and be gel filled.

C. Terminal Boxes, Junction Boxes and Cabinets:
   1. All boxes and cabinets shall be DIN listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL

A. The FACP shall be a FCI and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. System Capacity and General Operation:
   1. The control panel shall provide, or be capable of expansion to 2000 intelligent/addressable devices.
   2. The system shall include Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (Style Y) programmable Notification Appliance Circuits.
   3. The system shall support programmable driven relays.
   4. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
   5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
   6. The FACP shall provide the following features:
      a. Drift Compensation to extend detector accuracy over life.
      b. Sensitivity Test
      c. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
      d. System Status Reports to display or printer.
      e. Alarm Verification, with verification counters.
      f. PAS presignal.
      g. Rapid manual station reporting (under 2 seconds).
      h. Non-Alarm points for general (non-fire) control.
      i. Periodic Detector Test, conducted automatically by software.
      j. Pre-alarm for advanced fire warning.
      k. Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
      l. March time and temporal coding options.
      m. Walk Test, with check for two detectors set to same address.

n. Security Monitor Points.
o. Control-By-Time for non-fire operations, with holiday schedules.
p. Day/Night automatic adjustment of detector sensitivity.
q. Device Blink Control for sleeping areas.

C. Central Microprocessor:
1. The Microprocessor shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. Display:
1. The display shall provide all the controls and indicators used by the system operator and may be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
3. The display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE-ALARM.
4. The Display shall provide a key touch key-pad with control capability to command all system functions, entry of alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The Display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

E. Signaling Line Circuit (SLC):
1. The SLC interface shall provide power to and communicate with intelligent detectors (Ionization, Photoelectric, or Thermal) and intelligent modules (monitor or control). This shall be accomplished over a single SLC loop and shall be capable of Style 4 or Style 6 wiring.
2. The loop interface shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet all local VDE and VdS requirements and be certified by VdS as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:
1. An EIA-232 interface between the Fire Alarm Control Panel and Listed Electronic Data Processing (EDP) peripherals shall be provided.
2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible

computers.

3. The EIA-232 interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.
4. An EIA-485 interface shall be available for the serial connection of remote annunciators and LCD displays.
5. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.

G. Enclosures:
1. The control panel shall be housed in a DIN listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

H. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients, consistent with DIN standards.

I. An optional module shall be available which provides Form-C relays rated at 5.0. The relays shall track programmable software zones.

J. Power Supply:
1. The Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
2. It shall provide 5.0 amps of usable Notification appliance power, using a switching 24 VDC regulator. A 3.0 amp notification expansion power supply shall be available for the demanding requirements visual devices, for a total system capacity of 8 amps.
3. It shall provide a battery charger for 30 hours of standby using dual-rate charging techniques for fast battery recharge.
4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. It shall be power-limited.
6. It shall provide optional meters to indicate battery voltage and charging current.

K. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.
1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 30 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount backbox.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay requirements.
5. The FCPS include power limited circuitry.

L. Field Wiring Terminal Blocks:
1. For ease of service all panel I/O wiring terminal blocks shall be a removable, plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks, which are

permanently fixed, are not acceptable.

M. Operators Controls:
   1. Acknowledge Switch:
      a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and Trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
      b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
   2. Signal Silence Switch: Activation of the Signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenced by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
   3. System Reset Switch: The system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
      a. Holding the system RESET switch shall perform a lamp test function.
   4. Drill (Evacuate) Switch:
      a. The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

N. Field Programming:
   1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
   2. All programming may be accomplished through the standard FACP keypad.
   3. All field defined programs shall be stored in non-volatile memory.
   4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
   5. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.
   6. A special program check function shall be provided to detect common operator errors.
   7. An Auto-Program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
   8. For flexibility, an off-line programming function, with batch upload/download, shall also be available.

O. Specific System Operations:
   1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the control panel. Sensitivity range shall be within the allowed window.
   2. Alarm Verification: Each intelligent addressable smoke detector in the system shall be independently selected and enabled to be alarm verified. The alarm verification delay shall be programmable from 5 to 30 seconds. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
   3. Point Disable: Any device in the system may be enabled or disabled through the

system keypad.

4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
   a. Device status.
   b. Device types.
   c. Custom device labels.
   d. View analog detector values.
   e. Device zone assignments.
   f. All program Parameters.
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing system status.
6. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 800 system alarms/troubles/operator actions. Each of these activation's will be stored and time and date stamped with the actual time of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed in its entirety.
   a. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 800 system events.
   b. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.
   a. If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 99 software zones. All addressable devices may be field programmed to be grouped into software zones for control activation and annunciation purposes.

2.4 SYSTEM COMPONENTS

A. Signaling Devices:
   1. STROBES (as required by Code):
      a. Strobes shall be provided as required and indicated on the contract drawings and shall have a flash rate not to exceed 60 times per minute.
      b. The word "Fire" shall appear on the lens or lens plate.
      c. Strobes shall be a 15cd, 1Hz minimum for restrooms and 75cd, 1Hz for large rooms (i.e., library, multi-use, meeting, etc.).
      d. Strobes shall mount to 2 gang box, flush or surface as shown on drawings.
   2. Speakers (as required by Code):
      a. Speakers shall be provided as required and as indicated on the contract drawings.
      b. Speakers shall mount to a 4 sq. box. for interior use and a cast weatherproof, gasketed box for exterior use.

c. Speakers shall be white or red in color.
d. Sound pressure level shall be 85dBA at 10 feet
e. Screw terminals shall be provided for field connections.
f. Unit may be configured with optional Strobe for interior speaker/Strobe applications.

3. SPEAKER/STROBES (as required by Code):
   a. Speaker/Strobe combination units shall be supplied as required and as indicated on the contract drawings.
   b. Strobes shall not to exceed 60 flashes per minute.
   c. The word “Fire” shall appear on the lens or lens plate.
   d. Strobes shall be a 15cd, 1Hz minimum restrooms and 75cd, 1Hz for large rooms (i.e., library, multi-use)
   e. Wiring for Strobes shall be separate from Horn Circuits. Strobes shall mount to face of Horn unit.
   f. Wiring for Horns shall be separate from Strobe Circuits. Horns shall mount to a 4 sq. box. for interior use.
   g. Horns shall be red in color.
   h. Sound pressure level shall be 85dBA at 10 feet
   i. Screw terminals shall be provided for field connections.

B. Addressable Devices – General:
1. Addressable Devices shall provide an address-setting means using rotary decimal switches.
2. Addressable Devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches. Devices, which use a binary address setting method, such as a dip switch, are not an allowable substitute.
3. Detectors shall be intelligent and addressable, shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by DIN, VDE and/or VdS as meeting the calibrated sensitivity test requirements.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. An optional base shall be available with a built-in (local) sounder rated at 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

C. Addressable Pull Box (manual single station as required by Code):
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication

module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

D. Intelligent Photoelectric Smoke Detector:
1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

E. Intelligent Thermal Detectors:
1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

F. Intelligent Duct Smoke Detector:
1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

G. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

H. Two Wire Detector Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

I. Addressable Control Module:
1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the

control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

J. LCD Alphanumeric Display Annunciator:
1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of forty (40) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. Up to 32 LCD annunciators may be connected to an EIA 485 interface. LCD annunciators shall not reduce the annunciation or point capacity of the system. Each LCD shall include vital system wide functions such as, System Acknowledge, Silence and Reset.
4. LCD display annunciators shall mimic the main control panel 80 character display and shall not require special programming.
5. The LCD annunciator shall have switches that may be programmed for System control such as, Global Acknowledge, Global Signal Silence and Global System Reset. These switch inputs shall be capable of being disabled permanently or by a key lockout function on the front plate.

2.5 BATTERIES:

A. Shall be 12 volt, Gell-Cell type (two required).

B. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours (24) plus fifteen minutes (15) of alarm upon a normal AC power failure.

C. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the VDE, DIN, EN, VdS Standards, along with local codes, as shown on the drawings, and as recommended by the equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

PART 4 GUARANTEE AND TEST

4.1 GENERAL

A. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance by consultant.

B. Acceptance shall consist of the following:
   1. Burn-in period.
      a. The system shall be accepted for start of warranty upon successful completion and testing of AHJ and Consultant.
      b. Burn-In period shall be a 30 day time frame to allow the system to operate free of defects, grounds, programming faults, etc.
      c. The 30 day Burn-In shall begin the day of acceptance by AHJ.
      d. The Burn-In period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.
      e. Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification by owner’s personnel and correct said deficiencies.
      f. Upon correction and restoration, the “Burn-In” period shall be re-set to “0” and the 30 day count shall begin again.
      g. Start of Warranty shall commence upon day 31 of successful “Burn-In” period.

4.2 FINAL TEST (AS APPLICABLE FOR PROJECT DEVICES)

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with VDE, VdS and DIN Standards.
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
   3. Verify activation of all flow switches.
   4. Open initiating device circuits and verify that the trouble signal actuates.
   5. Open and short signaling line circuits and verify that the trouble signal actuates.
   6. Open and short Notification Appliance Circuits and verify that trouble signal actuates.
   7. Ground all circuits and verify response of trouble signals.
   8. Check presence and audibility of tone at all alarm notification devices.
   9. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.
   10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
   11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

B. Before the installation shall be considered completed and acceptable by the awarding authority, a test on the system shall be performed as follows:
   1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, the inspector of record (IOR) and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.
   2. Audibility tests shall be performed utilizing a calibrated Decibel Meter. The system shall be capable of supplying 15dB over ambient noise levels. Tests shall be conducted in the presence of the Consultant and AHJ at selected locations by Consultant/AHJ. Prior to acceptance, testing the contractor shall have verified signal levels in each area as to meeting the above criteria.
   3. Where application of heat would destroy any detector, it may be manually activated.
   4. The initiation circuits and the indicating appliance circuits shall be opened in at least two (2) locations per zone to check for the presence of correct supervisory circuitry.
   5. When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.
   6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance and successful burn in period.
   7. Prior to final test, the fire department must be notified in accordance with local requirements.
   8. Submit completed Certification form. The form shall be submitted in type written format. Hand written forms will not be accepted.

4.3 AS-BUILT DRAWINGS, TESTING, AND MAINTENANCE INSTRUCTIONS

A. A complete set of reproducible "as-built" drawings in AutoCAD R2015 format (CDs and sheets) showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system acceptance.

B. Operating and Instruction Manuals:
   1. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to the owner upon completion.
   2. The owner shall be furnished with all programming disks for each installation as well as hard copy printouts. Provide necessary training and/or schooling to designated owner personnel at no additional cost to owner. Training shall be at the owner’s designated location, by factory trained personnel. Provide all necessary interconnection cables for remote programming via “laptop” computer.

C. Testing Frequency Instructions:
   1. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a complete trouble-shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to the owner upon completion of the system.

D. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
   1. Instruction on replacing any components of the system, including internal parts.

2. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions
3. A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.
4. User operating instructions, shall be provided prominently displayed on a separate sheet located next to the control unit.
5. Administrative staff of the school shall be thoroughly instructed in the use of system by authorized distributor. Such service shall be provided in conjunction with the Fire Alarm equipment.
6. Staff of the Park as well as owner maintenance staff shall be thoroughly instructed in the use of the System. Training shall include a minimum of three (1) hour sessions, to be scheduled at the Owner's designated time.
7. Maintenance instruction shall be performed in the same manner as described above. Training shall include a minimum of three (1) hour sessions, to be scheduled at the owner's designated time.

END OF SECTION 26 47 21

SECTION 26 47 45 NETWORKING & DATA COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. SCOPE
1. This section outlines the requirements for the Local Area Networks system switches, system hubs, networking modules (transceivers) and connectivity at the MC/MDF and at the various IC/IDF's throughout the owner's facility.
2. Administrative Network
   a. The Administrative Network distribution components will be located in telecom room MDF and in various communications rooms throughout the facility. The system is connected via CAT 6A cabling to various server and workstation locations throughout the building.
   b. Administrative Network nodes are located throughout the building.
   c. These are fed by fiber optic cabling to the MDF and distributed locally via UTP CAT 6A (as noted on the plans) cabling infrastructure. The Administrative Network will be a Fast-EtherNet design providing switched 500Mbit speed to various workgroups in the facility.
   d. The contractor will be responsible to install, program, test and document the system as installed, verifying throughput rates.
   e. The contractor will be required to work in close coordination with the owner's information systems director and staff.

1.2 WORK INCLUDED

A. Furnish and install all required system switches, system hubs, system 100/1000BASE-T modules, transceivers, patch cables and accessories for a complete system.

B. The installation shall include interconnect/patching equipment (fiber and copper), jumpers (optical fiber and twisted-pair copper), hub & switch equipment, optical fiber transceivers, routers, asynchronous controllers, optical fiber transceivers, and any other equipment enumerated within. In addition to material and equipment, contractor shall provide labor and any incidental material required for installation. All active equipment shall be installed and connected to the cable system.

C. Configuration, programming and testing of the local area networks.

D. New local area network locations are listed on the drawings.

1.3 RELATED DOCUMENTS

A. SECTION 260000 - GENERAL ELECTRICAL CONDITIONS;

B. SECTION 264750 - CABLING & DISTRIBUTION SYSTEMS

1.4 FUNCTIONAL REQUIREMENTS

A. Transmission Media. The example LAN will use both twisted-pair and fiber optic cable plant

to provide connectivity between user workstations located in offices and network resources located in the facility computer room(s).

B. Host/Server Access. The network will allow users to access all host/server resources, including future application servers, such as additional database servers. There should be full compatibility with existing initiatives (e.g., a new financial system, security system, and telephone and employee services database repository).

C. Outside Communications. The network will need to support future access to external networks through routers. These communications will use the Transport Control Protocol/Internet Protocol (TCP/IP) protocol.

D. Environment/Facility Considerations. The network architecture design must take into account existing space, power, and heat constraints.

E. Flexible Architecture. The design must have sufficient flexibility to permit grouping users into distinct "workgroups" for office automation services. Physical features, such as a layered distribution scheme, redundant patching, and real-time configuration and topology modifications, will be included in the design. The overall transition strategy should minimize downtime and denial of service.

F. Office Automation Services. The network will support a broad range of office automation services for DOS, Windows, and Macintosh workstations. The following services will be provided:
1. File storage and retrieval;
2. Network printing;
3. Support of commercial off-the-shelf (COTS) desktop applications (in the DOS, Windows and Macintosh environments), including electronic mail and calendaring; and fax services.

1.5 OPERATIONAL REQUIREMENTS

A. Network Management. The design will contain methods and tools for the efficient management and control of the network. The capability to monitor and manageboth network traffic and physical components of the network will be provided.

B. Fault Recovery. The design will include contingency or back-up plans should any element of the network fail.

1.6 PERFORMANCE REQUIREMENTS

A. Network Response. The servers and other components of the network must be sized to avoid unacceptable start-up delays when workstations are first activated, long login times, and slow response during normal network utilization (e.g., application startup and exit, file retrieval and save operations). Response times for network desktop applications should not be significantly greater than stand-alone usage.

B. Network Availability. The users must be able to access the network 24 hours a day, seven days a week unless specifically made unavailable at organization discretion(e.g., for administrative or maintenance activities).

1.7 NETWORK CAPACITY: INDIVIDUAL COMPONENTS OF THE NETWORK WILL BE SIZED AS INDICATED BELOW:

A. The cable plant -- The cable plant will provide for approximately 150 cable drops distributed throughout the offices and facility.

B. User workstations -- Initially, service will be provided for approximately 50 local users. However, when fully operational, the network will be capable of supporting approximately 150+ local users (150+ Windows-based PCs and servers).

C. Intelligent hub equipment -- All hub equipment will be sized to support all ports plus 25% spare ports for growth.

1.8 REFERENCES AND STANDARDS INCORPORATED

A. Published specifications, standards, tests or recommended methods of trade, industry or government organizations apply to work of this section where cited by abbreviation noted below:
1. EIA Electrical Industries Association
2. IEEE Institution of Electrical and Electronics Engineers
3. ISO International Standards Organization
4. ITU International Telecommunications Union
5. CCITT Consultative Committee of International Telegraph and Telephone
6. ANSI American National Standards Institute
7. TIA Telecommunications Industry Association
8. ASTM American Society for Testing and Materials
9. NEC National Electric Code
10. FCC Federal Communications Commission
11. CEA Insulated Cable Engineers Association, Inc.
12. IEC International Electrotechnical Commission
13. NEMA National Electrical Manufacturers Association
14. UL Underwriters' Laboratories, Inc.
15. IPC The Institute for Interconnecting and Packaging Electronic Circuits
16. NFPA National Fire Protection Association
17. BICSI Building Industry Consulting Service International

B. Nothing in the drawings, details, or specifications shall be construed to permit work not conforming to applicable laws, ordinances, rules, or regulations and standard industry IEEE 802 Ethernet standards.

C. It is not the intent of the drawings, details, or specifications to repeat requirements of codes except where necessary for completeness or clarity.

1.9 SUBMITTALS

A. Submit manufacturer's data literature for each item used describing each product, including specification, installation instructions and general recommendations.

B. Submit manufacture's data literature on system hubs, switches, 100/1000BASE-T modules, 100/1000BASE-FB modules, 100/1000Base2 modules, power supplies and accessories.

C. As per section 260000 - General drawings, submittals and shop drawings.

D. In addition to the requirements of Division 1, submit all materials for approval, arranged in same order as specifications, individually referenced to specification paragraph and drawing number. Submit number required in Division 1 plus three (3) copies of 8 1/2” x 11" material and 2 prints and one reproducible of drawings in 24” X 26” size, minimum. Submit 8 1/2” x

11” items bound in volumes and 24” X 36” drawings in edgebound sets.

E. Progress Schedule: Include duration and milestones for the following:
1. All submittals specified.
2. Completion of equipment buyout.
3. Completion of equipment receipt at fabrication shop.
4. Shop fabrication.
5. Shop testing.
6. Shipment to site.
7. Installation.
8. Field testing.
9. Training.
10. First use date.

F. Manufacturer's Product Data:
1. List of Materials: For each item include:
   a. Manufacturer.
   b. Model number.
   c. Listing: UL, City Lab or none.
   d. Quantity.
2. Manufacturer's Product Data: In sequence of list of materials, data sheet for each item, including all accessories, marked for proposed product.

G. Field and Shop Drawings:
1. Resubmit: for coordination reference complete with corrections from previous submittal:
   a. List of Materials.
   b. Manufacturer's Product Data.
2. Field (installation) Drawings: collate in sequence:
   a. Drawing index/symbol sheet.
   b. Floor plans. At scale of contract documents. Show:
      1) Devices with circuit number.
      2) Rough-in.
      3) Mounting height.
      4) Conduit size.
      5) Wire type.
      6) Wire fill.
   a. Sections/Elevations. At scale of contract documents.
      1) Mounting Location Reference
   b. Enlarged Plans. At scale of contract documents or larger as required for trade coordination. Show:
      1) Refer to floor plans.
      2) Architectural features.
      3) Rack cabinets.
      4) System furniture.
      5) Clearances.
   c. System conduit riser drawing, show:
      1) Terminal cabinets.
      2) Coordination with floor plans.
      3) Wire runs not shown on floor plans.
      4) Wire type.
      5) Wire fill.
   d. Mounting details
      1) Stamped and signed by engineer licensed in jurisdiction for work of this type.
      2) Show loads, strength of connections, etc.
      3) Show calculations - on drawings or in bound volume forreview by authorities having jurisdiction.

4) Provide details for:
a) Racks.
5) Installation details as required.
6) Terminal cabinets: terminations.

e. Wire run sheets (if used) show:
1) Wire number.
2) Source.
3) Designation.
4) Signal type.
5) Wire type.
6) Operating level or voltage (if applies).

f. Shop and Field Test Reports

3. Schedule: Submit test reports in timely manner relative to project schedule such that owner may conduct verification of submitted test data at owner's option, without delay of progress.
a. Shop test report: Submit prior to shipping completed system to project site.
b. Field test report: Submit following system completion and prior to and as condition precedent to owner's acceptance of the work of this section.

4. Test Reports: Include:
a. Time and date of test.
b. Personnel conducting test.
c. Test object.
d. Procedure used.
e. Test equipment, including serial and date of calibration.
f. Results of test - numerical or graphical presentation.

5. Verification of submitted test data: Owner may elect to verify some or all test data submitted. Retest in presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this section. Provide all test equipment.

H. Reference Data for Operation, Maintenance and Repair
1. In addition to the requirements of Division 1, submit 3 sets. Submit in three post binders (not ring binder) with tabs.
a. Index.
b. Systems operating instructions.
c. Reduced set of system record drawings.
d. Key schedule.
e. Maintenance and spare pans schedules.
f. Shop and Field Test Reports.
g. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.

I. Record Drawings in AutoCAD R2010 format
1. Quantity:
a. Review sets: as for shop and field drawings.
b. Record set:
1) Three (3) bluelines.
2) One CD with applicable .DWG files as full scale
c. Content: All drawings required under “Field and Shop Drawings”. Show as installed condition.

PART 2 PRODUCTS

2.1 GENERAL

A. Quality of Products: Material and equipment specified herein have been selected as the basis of acceptable and desired quality of performance and have been coordinated to function as components of the specified system. Where a particular material, device, piece of equipment of system is specified directly, the current manufacturer's specification for the same shall be considered to be part of these specifications, as if completely contained herein in every detail. Each material, device, or piece of equipment provided hereunder shall comply with all of the manufacturer's published specifications for that item.

B. Quantity: Provide quantity as shown on contract drawings, the schedule or as otherwise defined herein.

C. Preference: Owner desires system to be furnished and installed as specified herein.

D. Substitutions: Comply with SECTION 16010 -GENERAL CONDITIONS.

E. Provide complete: Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the work of this section at, if specified in full herein.

F. Provide new: All materials provided under the work of this section shall be new, shall be the manufacturer's latest design/model, and shall be permanently labeled with the manufacturer's name, model number and serial number.

G. Similar: Similar devices shall be of the same manufacturer, unless specifically noted otherwise in these specifications.

H. Continuous Use: All active circuitry shall be solid state and shall be rated for continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and shall contain sufficient permanent identification to facilitate replacement.

2.2 MANUFACTURERS

A. NETWORKING HARDWARE
   1. System design is based on products as manufactured by Cisco, 3Com or BayNetworks Substitutions must be pre-approved according to Sectin 16010 and general conditions.

B. SYSTEM SPECIFICATIONS
   1. LOCAL AREA NETWORK
      a. The Local Area Network shall be based on and support IEEE802.3 functional standards for EtherNet Local Area Networking. This shall include IEEE 802.3 100/1000BASE-T and 100/1000BASE-T for station microcomputers, and IEEE 802.3 100/1000BASE-F or 100/1000BASE-F (FIORL) synchronous technology for fiber optic repeater interconnection.
      b. The main distribution frame (MDF) and all intermediate distribution frames (IDF's) shall support one EtherNet segment per network.
      c. System shall be sufficient to support use at full capacity without user-perceptible delays in network response time.
      d. System shall be sufficient to support any combination of system features at full capacity. System shall allow reconfiguration of backbone to allow Customer maximum flexibility and implementation of options in case of need when future services are identified and added.

C. LAN CONFIGURATION
   1. System hubs are required in DESIGNATED zones so that every data drop on site can be serviced by a hub.

2. Each system hub shall allow for growth, without the need to add an additional hubs to 125% of the current data drop count for the area of the campus that it serves even though all those drops will not be connected at initial installation.
3. Each designated location shall utilize a system hub as per the specification.
4. Each hub location shall utilize fiber optic transceiver module for connection to the fiber optic backbone or horizontal distribution (where fiber is utilized as the backbone or horizontal media).
5. Each hub location shall utilize 100/1000BASE-T(RJ45), 100/1000BASE-T (RJ45), unshielded twisted pair ports for connection to the UTP CAT 6A LAN cable plant or 100/1000BASE-2 ports for connection to the ThinLAN cable plant. The quantity of initially installed 100/1000BASE-T/100/1000BASE-2 ports shall be per the needs indicated and requirements of this specification and contract drawings.
6. The initially active 100/1000BASE-T, 100/1000BASE-T locations shall be connected to the system Hubs via CAT 6A UTP patch cords and patch panels. If Telco style 100/1000BASE-T modules are utilized in the system Hub then CAT 6A, Telco-to RJ45 patch panels shall be installed with the appropriate cable to the hub for full connectivity.

2.3 MATERIALS AND EQUIPMENT

A. SYSTEM HUBS

1. The Local Area Network shall be created from a family of intelligent, or "smart," switches, hubs and related products. The product family shall consist of various hubs; numerous plug-in EtherNet, FDDI, and internetworking modules for these hubs, and network management software. These products shall enable the customer to create a large-scale facility network that is flexible, reliable, and manageable.
2. The System shall have port switching technology that shall offer remote network configuration and management capabilities.
3. The System's network management shall support network analysis, identify specific network problems, and correct or self-heal problems dynamically. The system's network management shall not be a passive traffic monitoring tool.
4. System hubs shall have the following parameters and features:
   a. Modular Multi-Media Chassis.
   b. Supports SNMP Based Network Management System.
   c. Supports Inband and Out of Band Network Management.
5. Specific EtherNet features required:
   a. Supports Shielded/Unshielded Twisted Pair, Coax, AUI & Synchronous Fiber.
   b. Supports Internal EtherNet Terminal Servers for TCP/IP.
   c. Supports Fiber Links Up to 2.0 Kilometers.
6. System hub shall be provided in 12, 24, or 48 port versions. The system hub shall be able to be mounted in a rack and installed from the front.
7. Transceiver slots for connection of twisted pair 100/1000Base-T, Thin LAN or fiber optic FIORL.
8. The unit shall include and Intel I960 RISC-based processor, 1 Mbytes of RAM and 256Kbytes of flash EEPROM.
9. Complete workgroup security including: intruder prevention, auto port disabling, network management alarm, leaves drop prevention, authorized managers list and password protection.
10. Provisions for added SNMP management module.
11. Intelligent error monitoring, intelligent segmentation recovery, auto-segmentation, fault isolation and integrity.
12. Support for SNMP/IP and IPX multi-vendor management with SNMP browsers.
13. The unit shall be UL rated and meet FCC Part 15 Class A emissionsstandards.
14. The unit shall be provided with a lifetime limited, 5 year on site warranty.
15. The system hub must be capable of implementation to include all of the following features:

a. A single-port FOIRL module shall be available to provide FOIRL-based EtherNet connections through the system hub. The module shall comply with the IEEE FOIRL and 100/1000BASE-FL and 100/1000BASE-FL standards which ensures interoperability with other vendors' FOIRL-compliant devices. In addition, users in a FOIRL environment shall be able to take advantage of the system hub benefits such as multi-channel architecture, port redundancy, and fault tolerance.
b. The FOIRL module shall achieve point-to-point connections longer than the 1 kilometer specified by the IEEE FOIRL specification by use of high power optics.
c. A FOIRL transceiver shall be available to link a network station to EtherNet 100/1000BASE-FL LANs using fiber-optic cable. The FOIRL transceiver shall attach directly to the AUI port on the network station eliminating the need for an AUI cable.
1) The FOIRL transceiver shall comply with the IEEE 802.3 100/1000BASE-FL draft standard and offers low-light level detection for error-free transmission.

16. An EtherNet transceiver module shall be available to provide AUI connectivity to the system hubs.
17. An EtherNet BNC module shall be available to provide a single connection to thin-wire EtherNet segments up to 185 meters in length.
a. The BNC module shall be fully compliant with the IEEE 100/1000BASE-2 standard. All thin wire segments shall be able to be terminated either internally or externally.

B. Approved Suppliers
1. The following vendors have been pre-approved to supply product under this contract:
a. Cisco
b. 3Com
c. Bay Networks
d. Others submit in accordance with substitution requirements.

PART 3 EXECUTION

3.1 GENERAL

A. Provide installation logs supporting building infrastructure.

B. Configure and cross connect all ports as required for complete end to end system.

3.2 DRAWING DETAILS (SHOP DRAWINGS)

A. Show wall elevation and wire details on shop drawings. Show equipment function, make and model and wire routing and terminations within rack or cabinet.

B. Show as-built location of all devices on shop drawings.

C. Provide 3 sets of bound operation and maintenance manuals, including submittal materials, and record of field changes. Provide complete as-built wiring diagrams in AutoCAD2000 format. Provide CD files and original tracings (E size) in format of construction drawings. Input all cabling information into ACS system and provide a detailed printed report with as-builts.

3.3 QUALITY CONTROL

A. Evidence of Experience and Qualifications

1. Show that the contractor who will perform the work has a minimum of 5 years experience successfully installing system of the same type and design as specified herein. Include the names, locations, and points of contact of at least two similar installations of the same type and design as specified herein where the installer has installed such systems. Indicate the type of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 12 months.
2. Show that the instructor, who will train staff, operating and maintenance personnel, has received a minimum of a CNE/MCE training from a factory training center, and 2 years experience in the installation of systems of the type specified. Submit training certification in equipment submittals, title section training and certifications.

3.4 TESTING

A. GENERAL
   1. Testing shall be performed in the presence of the owner.
      a. Testing shall include verification of:
         1) Server operation and configuration
         2) NOS installation, configuration and operation
         3) HUB insulation and operation
         4) Cable Plant
   2. All test equipment shall bear current calibration stickers or dated certificates.
   3. Printed test results along with as-built drawings shall be assembled into a 3 ring project binder and delivered to the consultant for verification and final acceptance prior to start of warranty.

3.5 COMMISSIONING

A. General
   1. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance by owner.
   2. Acceptance shall consist of the following:
      a. Burn-in period.
         1) The system shall be accepted for start of warranty upon successful completion and testing of the system.
         2) Burn-in period shall be a 30 day time frame to allow the system to operate free of defects, grounds, programming faults, etcetera.
         3) The 30-day burn-in shall begin the day of acceptance by owner.
         4) The burn-in period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.
         5) Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification by owner’s personnel and correct said deficiencies.
         6) Upon correction and restoration, the burn-in period shall be re-set to “0” and the 30 day count shall begin again.
         7) Warranty shall commence upon day 31 of successful burn-in period.
      b. Final Test
         1) Before the installation shall be considered completed and acceptable by the awarding authority, a test on the system shall be performed as follows:
            a) The contractor's job foreman, in the presence of a representative of the manufacturer, and a representative of the owner shall operate every network device to ensure proper operation and correct configuration at the file server location.

b) When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner.
c) The contractor shall leave the data network system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the consultant.

B. As Built Drawings, Testing, and Maintenance Instructions
1. A complete set of reproducible as-built drawings in AutoCAD R2000 format (CDs and sheets) showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system acceptance.
2. Operating and Instruction Manuals
   a. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to the owner upon completion.
   b. Provide necessary training and/or schooling to designated owner personnel at no additional cost to owner. Training shall be on site.

C. Testing Frequency Instructions
1. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a complete trouble-shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to the owner upon completion of the system.
2. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
   a. Instructions on replacing any components of the system, including internal parts.
   b. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions
   c. A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.
   d. User operating instructions shall be provided, prominently displayed on a separate sheet located next to the control.

END OF SECTION 26 47 45

SECTION 26 47 50 CABLING AND DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Provide a complete, tested, Cable Distribution system for Data Processing and Networking systems (local area network), Telecommunications (voice), Audio (paging), Entry Access Control and Monitoring (security) and Closed Circuit Video Surveillance systems (CCTV) as follows:
   1. The data distribution system shall include fully terminated fiber optic backbone and CAT-6A STP station cables and specialty data distribution cables and terminations as shown in the contract drawings. All fiber optic trunk cabling will be installed into utility conduit loops around the park in fiber inner-duct. Station cabling will be installed in conduits and office furniture provided by others. This work includes all backbone, horizontal distribution, station cabling and specialty stations/horizontal distribution cabling for the Administration, Point of Sale, Audio, Security, Irrigation and CCTV systems. The contractor shall be responsible to provide and install all cabling, wiring, cabinets, racks, data frames, cable tray, wire management, power distribution, blank panels, structural bracing, inner ducting, termination panels (fiber and UTP), complete testing and certification, along with all as built documentation as set for in these specifications.
   2. The voice distribution shall include fully terminated multi pair trunk cablingand CAT-6A STP station cabling along with specialty outdoor cabling and terminations for food carts and retail carts as indicated on the contract drawings. Contractor shall be responsible to provide and install all cabling, wire management, backboards, equipment cabinets, ladder racking, station cabling, specialty cabling, boxes, outlet terminations, splicing (as needed). All voice cabling underground shall use a rated OSP cable. All above ground cabling in conduit may use a CMP rated cable. Conduits and pathways will be installed by others and will be in place prior to the start of wire/cable installation. Complete testing and certification, along with all as built documentation as set for in these specifications.
   3. The entry access control and monitoring will utilize a segment of the fiber optic backbone, feeding terminal controllers and I/O boards (FBO) monitoring various security and equipment functions throughout the project. Distribution cabling from controllers and I/O boards are copper cables (coordinate requirements with security contractor) which will provide monitoring to point sensors, motion sensors, equipment, fire protection systems and alarm monitoring. Cabling will be installed into existing underground and above ground conduits. The contractor will be required to provide and install all cabling, terminations, connections, wire management and incidentals for a complete cabled system. Cabling underground shall utilize an OSP rated cable. Cabling above ground shall use a CMP or CL2 or plenum/tray rated cable depending on the application. Complete testing and certification, along with all as built documentation as set for in these specifications.
   4. Fiber Optic Riser Cables: Individual 6-fiber, 8-fiber, 12-fiber, 18-fiber, 24-fiber or 48-fiber optical cables shall be installed from the termination enclosure in the new IT Room to fiber optic termination enclosures in each new DATA IC Communications Closets at each cluster attraction area as shown on the plans.

B. Provide system design services (development of specific details consistent with the contract documents) as required to complete shop drawings for data cable systems including detailed documentation for owner’s review and detailed documentation of as-built conditions.

C. Data concentrators, local area network controllers, and data terminal equipment will be furnished by others under separate contract. The contractor shall coordinate with other system vendors where appropriate to facilitate equipment backboard installation, scheduling, protection of equipment, and access to the project site in order to provide owner a complete project in a timely manner.

D. The successful cabling contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by owner prior to the start of work.

E. Raceway Systems Specifications required for voice, data, audio, video systems cables may be found in Electrical Specifications.

F. The successful bidder will not be determined by price alone, but by a rating system to include a combination of price, qualifications, training procedures and proposed documentation package.

G. All unused conduits or interducts shall have metered pull strings.

1.2 DESIGN

A. Floor Plans: Furnish floor plans for review showing outlet locations with an indication of outlet type and proposed label. Floor plans shall be coordinated with architectural and electrical power plans and shall be produced at the same scale as the contract documents (see part 1.4, Submittals).

B. Terminal Elevations: Furnish details showing terminal block and backboard elevations including all cable terminals, spaces for equipment, equipment racks, and station cable routing. Communications equipment closets (intermediate distribution frames - MC) shall be arranged to maximize the utility and growth potential available in spaces shown on the floor plans. Terminal elevations shall be based on detail elevations included in the contract documents and shall show additional detail as indicated herein.

C. Outlet Locations: Provide as shown.

D. Terminal Schedules: Furnish terminal outlet schedules showing terminal block position for all station cabling. Terminal outlet schedules shall show proposed labels for all 4-pair STP horizontal cables at station outlets along with patch or 110 frame locations.

1.3 LOCAL AREA NETWORK (OVERVIEW, ELECTRONICS FBO – REFERENCE ONLY)

A. The Local Area Network shall be based on and support IEEE 802.3 functional standards for Ethernet Local Area Networking. This shall include IEEE 802.3 10/100BASE-T for station microcomputers, and IEEE 802.3 10/100BASE-FX(FIORL) synchronous technology for fiber optic repeater interconnection.

B. The main distribution frame (MDF) and all intermediate distribution frames (IDF's) shall support up to 12 Ethernet segments (Administrative Network, POS, Security, Audio, Irrigation and Lighting).

C. System Switches (FBO) shall be sufficient to support use at full capacity without the need to add Switch chassis. System shall be sufficient to support use at full capacity without user-perceptible delays in network response time.

D. System shall be sufficient to support any combination of system features at full capacity. System shall allow reconfiguration of backbone to allow Customer maximum flexibility and implementation of options in case of need when future services are identified and added.

E. LAN CONFIGURATION
   1. Each building or group of buildings supports an IDF that is a switch location. System Switches are required in DESIGNATED locations so that a switch can service every data drop.
   2. Each system switch shall allow for growth, without the need to add an additional switch, to 150% of the current data drop count for the area that it serves even though all those drops will not be connected at initial installation.
   3. Each designated location shall utilize a system switch as per the specification.
   4. Each switch location shall utilize Fiber Optic-Transceiver module for connection to the Fiber Optic backbone (where fiber is utilized as the backbone media).
   5. Each switch location shall utilize, 10/100BASE-T (RJ45) shielded twisted pair ports for connection to the UTP Category 6 LAN cable plant. The quantity of initially installed 100BASE-T ports shall be per the needs indicated and requirements of this specification.
   6. The initially active 10/100BASE-T locations shall be connected to the system switches via Category 5 STP patch cords and patch panels.

1.4 SUBMITTALS

A. Project Initiation: Within fourteen (14) days of Notice to proceed, the Low Voltage Contractor shall furnish the following in a single consolidated submittal:
   1. The name of the person who will act as the low voltage Contractor's official contact with the Contractor/Consultant.
   2. Electrical Permits. The Contractor shall obtain all required permits and provide copies to Consultant.
   3. Complete manufacturer's product literature for all cable, cross-connect blocks, cable supports, cable labels, outlet devices and other products to be used in the installation. In addition, whenever substitutions for recommended products are made (pre-approved prior to bid by Consultant), samples and the manufacturer's supporting documentation demonstrating compatibility with other related products should be included.
   4. A time sealed Construction Schedule using PERT/CPM indicating general project deadlines and specific dates relating to the installation of the cable distribution system. At a minimum, this Construction Schedule shall include the following milestones:
      a. Start of Communications space construction.
      b. Start of Fiber Optic cable terminations.
      c. Start of 4- pair STP and related termination hardware station cable installation.
      d. Start of Level 5e or 6e STP and Fiber Optic backbone cable testing.
      e. Start of Audio Cabling and related termination hardware and testing.
      f. Start of Security and CCTV Cabling and related hardware and testing.
      g. Final inspection.

B. Shop Drawings (within twenty-eight (28) days of notice to proceed).

1.5 SUBMITTALS

A. In addition to the requirements of Division 1, submit all materials for approval arranged in same order as Specifications, individually referenced to Specification paragraph and drawing number. Submit number required in Division 1 plus three (3) copies of 8 1/2” x 11" material and 2 prints plus one reproducible of drawings in 30” x 42” size, minimum. Submit 8 1/2” x 11” items bound in volumes and 30" x 42” drawings in edge-bound sets.

B. Progress Schedule: Include duration and milestones for the following:
   1. All submittals specified.
   2. Completion of equipment buyout.
   3. Completion of equipment receipt at fabrication shop.
   4. Shop fabrication.
   5. Shop testing.
   6. Shipment to site.
   7. Installation.
   8. Field testing.
   9. Training.
   10. First event date.

C. Manufacturer's Product Data:
   1. List of Materials: For each item, include:
      a. Manufacturer.
      b. Model number.
      c. Listing: UL, City Lab or none.
      d. Quantity.
   2. Manufacturer's Product Data: in sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product.

D. Field and Shop Drawings:
   1. Resubmit: for coordination reference complete with corrections from previous submittal.
      a. List of Materials.
      b. Manufacturer's Product Data.
   2. Field (installation) Drawings: Collate in sequence:
      a. Drawing index/symbol sheet.
      b. Floor plans. At scale of Contract Documents. Show:
         1) Devices with circuit number.
         2) Rough-in.
         3) Mounting height.
         4) Conduit size.
         5) Wire type.
         6) Wire fill.
      c. Sections/Elevations. At scale of Contract Documents.
         1) Mounting Location Reference
      d. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:
         1) Refer to 'floor plans".
         2) Architectural features.
         3) Rack cabinets.
         4) System furniture.
         5) Clearances.
      e. System conduit riser drawing, show:
         1) Terminal cabinets.
         2) Coordination with floor plans.
         3) Wire runs not shown on floor plans.
         4) Wire type.
         5) Wire fill.
      f. Mounting details
         1) Stamped and signed by consultant licensed in jurisdiction for work of this type.
         2) Show loads, strength of connections, etc.
         3) Show calculations - on drawings or in bound volume for review by authorities having jurisdiction.
         4) Provide details for:
            a) Racks.

b) Ladder racking
c) Mounting/attachment

g. Installation details as required.
1) Terminal cabinets: terminations.

h. Wire run sheets (if used) Show:
1) Wire Number.
2) Source.
3) Designation.
4) Signal Type.
5) Wire type.
6) Operating level or voltage (if applies).

3. Shop (Fabrication) Drawings: Collate in sequence:
a. Drawing Index/symbol sheet (if separate set from Field Drawings).
b. System functional drawings. Submit separate drawing for each system/subsystem. Show:
1) Equipment: Function, make, model.
2) Wire number.
3) Wire Type.
4) Shield condition at both ends (float, ground, location of ground).
5) Connector wiring details, each type.
6) Audio: Polarity, operating level.
7) Provide drawings for the following systems:
a) Control.
b) Audio.
c) Coordinated grounding scheme.

c. Equipment rack elevations. All racks scaled at one-inch equals one foot (1” = 1’ 0”), or larger. Show:
1) Power strip: receptacles, circuiting.

d. Rack wiring drawings for, each rack:
1) Power strip: receptacles, circuiting.
2) Equipment.
3) Grounding.
4) Wiring, all systems.
5) Wiring harness scheme.

e. Fabrication details submit for:
1) Receptacles.
2) Panels.
3) Special mounting provisions.
4) Custom enclosures, indicate:
a) Construction and bracing
5) Legends/engraving details. Half or full size:
a) Receptacles.
b) Panels.
c) Equipment.
6) Jackfield, terminations and cross connect details, Front elevation, full size.
a) Layout.
b) Text of designations.

E. Samples: Samples for approval by owner
1. Of all finishes/materials which will be visible to the public, including:
a. Receptacles and controls with associated trim plate
b. Each type of information outlet, faceplate, etc.
2. For other items, provide at least two of each as a sample.

F. Shop and Field Test Reports
1. Schedule: Submit test reports in timely manner relative to project schedule such that

owner may conduct verification of submitted test data at owner's option, without delay of progress.
   a. Shop test report: Submit prior to shipping completed system to project site.
   b. Field test report: Submit following system completion and prior to and as condition precedent to owner's acceptance of the work of this section.
2. Test Reports: include:
   a. Time and date of test.
   b. Personnel conducting test.
   c. Test Object.
   d. Procedure used.
   e. Test equipment, including serial and date of calibration.
   f. Results of test - numerical or graphical presentation.
3. Verification of Submitted Test Data: owner may elect to verify some or all test data submitted. Retest in presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this section. Provide all test equipment.

G. Reference Data for Operation, Maintenance and Repair
1. In addition to the requirements of Division 1, submit one (1) additional set.
2. Submit in three post binders (not ring binder) with tabs.
3. Index.
4. Systems operating instructions.
5. Reduced set of system Record Drawings.
6. Key schedule.
7. Maintenance and spare pans schedules.
8. Shop and Field Test Reports.
9. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.

H. Record Drawings in AutoCAD R2000 format
1. Quantity:
   a. Review sets: as for Shop and Field Drawings.
   b. Record set:
      1) Three (3) bluelines.
      2) One (1) mylar.
      3) CD with applicable .dwg files
2. Format: Record Set.
   a. Pencil, permanent ink or permanent photographic process.
   b. Front face only of Mylar at least 3.0 mils thick.
   c. Appliqué film or lettering prohibited.
   d. Suitable for microfilming.
3. Content: All drawings required under “Field and Shop Drawings”. Show “as installed” condition.

I. Shop Drawings. The contractor shall submit scaled drawings of all IC/MC backboard layouts showing hardware 110 frame placements prior to new installations. The name of the building, room #, title of room IC/MC, shall be included. The contractor must show dimensions for LAN network equipment backboard space. Coordinate with owner/consultant on any backboard discrepancies.

J. Proposed Contractor Category 5e or 6e STP, and fiber optic cable test result forms.

K. As a condition for project acceptance, the contractor shall submit the following for review and approval:
1. Complete manufacturer’s product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the

Project.

2. An exceptions list of deviations (in materials, construction and workmanship) from those specified in this section and shown on the Project Drawings. Owner will review this list and declare each item as either an approved exception, or as one the contractor must correct.
3. Inspection and Test Reports: During the course of the project the contractor shall maintain an adequate inspection system and shall perform such inspections to insure that the materials supplied and the work performed conform to contract requirements. The contractor shall provide written documentation, which indicates materials acceptance testing was conducted as outlined in Part 3 below. The contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion for owner/consultant analysis.

1.6 SYSTEM INSTALLATION REQUIREMENTS

A. System installer must have a BICSI RCDD on staff. Copy of certification must be submitted at time of bid.

B. The data cable system installer shall be a firm normally employed in the low voltage cabling industry with a reference list of five (5) projects and contact names to confirm successful Category 6A STP and Fiber Optic cable plant projects.

C. Owner reserves the right to exercise its discretion to require the Contractor to remove from the project any such employee of owner’s to be deemed incompetent, careless or insubordinate.

D. A fifteen (15) year manufacturer warranty shall be provided by the selected low voltage installer. This warranty shall include defects in material and workmanship. The warranty period shall begin at the date of owner's acceptance of the work. Quality and workmanship evaluation shall be made solely by owner/consultant and designated representatives.

E. The selected low voltage installer must be licensed and bonded.

F. All clean up activity related to work performed will be the responsibility of the Low Voltage Communication Contractor and must be completed daily before leaving the facility.

1.7 REGULATORY REQUIREMENTS

A. All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Uniform International Conference of Building Officials
   2. Building Code (ICBO); Regional Office
   3. BICSI

B. Other References:
   1. TIA/EIA- 569 Commercial Building Standard for Telecommunication
   2. Pathways and Spaces.
   3. TIA/EIA-568-A Commercial Building Wiring Standard
   4. EIA-455-171-D Standard Test Procedures for Fiber Optic Cables
   5. TIA/EIA-4750000-B Generic Specification for Fiber Optic Connectors
   6. TIA/EIA-475E000 Sectional Specification for Fiber Optic Connectors Type
   7. BFOC/2.5

8. TIA/EIA-604-X Fiber Optic Connector Intermateability Standards (FOCIS)
9. Leviton Telcom Category Compliant Design Criteria dated 1995 or Later
10. Leviton Telcom CCS Installation Training dated 1995 or later

C. Governing Codes and Conflicts: If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall be construed to permit work not conforming with all governing codes and regulations.

1.8 ABBREVIATIONS AND DEFINITIONS

A. MC - Main Cross-connect often co-located in the building Entrance Facility (E) and/or Equipment Room (ER) and consisting of riser cable terminals, utility service cable terminals, PBX terminals, and various other equipment.

B. IC - Intermediate Cross-connect usually residing in a Telecommunications

C. Closet (TC) and consisting of station wire terminals, riser cable terminals, and various equipment. Used to connect the first and second level backbone cables in a two-tier star wiring topology.

D. HC - Horizontal Cross-connect usually residing in a telecommunications closet and consisting of station wire terminals, riser cable terminals, and various equipment. Used to connect the first or second level backbone cables to the horizontal or work area cables.

E. PBX - Private Branch Exchange, a telephone switch.

F. PDS - Premises Distribution System, a common term used for the cable, terminals, and miscellaneous equipment comprising telephone and data transmission systems.

G. STP - Shielded Twisted Pair (telecommunications/data station cables)

PART 2 PRODUCTS

2.1 GENERAL WIRING

A. The inside/outside wiring plant shall be installed per requirements of these specifications utilizing materials meeting all applicable TIA/EIA standards.

B. Materials shall be as listed or shall be equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA568 specification. In some cases specific materials are called out to maintain a uniformity of application across all installations. The Contractor shall maintain the same material uniformity for all buildings.

C. All installed wire shall be tested and labeled 100% good after installation by the installer.

D. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
1. Communications Cable.
2. Plenum rated Communications Cable.
3. Riser rated Communications Cable.

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket, which would indicate possible problems. Damaged cable, or any other components failing to meet specifications shall not be used in the installation.

F. Quantity: Provide quantity as shown on Contract Drawings, the Schedule or as otherwise defined herein.

G. Preference: Owner desires system to be furnished and installed as specified herein.

H. Substitutions: Comply with GENERAL CONDITIONS.

I. Provide Complete: Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section at, if specified in full herein.

J. Provide New: All materials provided under the Work of this Section shall be new, shall be the manufacturer's latest design / model, and shall be permanently labeled with the manufacturer's name, model number and serial number.

K. Similar: Similar devices shall be of the same manufacturer, unless specifically noted otherwise in these specifications.

L. Continuous Use: All active circuitry shall be solid state and shall be rated for continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and shall contain sufficient permanent identification to facilitate replacement.

M. CABLE PLANT REQUIREMENTS
1. The cable plant shall be a star configured, unshielded twisted pair system capable of supporting data rates of 1Ghz.
2. The drop cable shall run from intermediate wiring closets (IDF’s) to each office, work station, attraction, food service and retail location as well as other miscellaneous locations as shown on the prints.
3. The trunk fiber optic cable shall run between the main distribution frame (MDF) and each switch (IDF) location as indicated on the project drawings.
4. The cable plant shall meet EIA/TIA-568 “Commercial Building Telecommunications Wiring Standard” and the maximum length of any STP data drop shall NOT exceed 100 meters including patch cables and future jumper cables at each information outlet location.
5. Every switch location shall have one 24 strand multi-mode/single (12mm, 12sm) mode hybrid fiber optic cable (dedicated) from the MDF for LAN service, UON.

N. CABLE PLANT SUPPLIERS
1. The wire provided for all voice trunk runs shall be UTP Category 5e cable UON (OSP rated for below grade use)
   a. Recommended suppliers: Berk-Tek, Essex, Belden, Lucent, Avaya.
2. The wire provided for all data and voice outlets shall be one four pair STP Category 5e or 6e cable per jack, UON (OSP rated for below grade use).
   a. Recommended suppliers: Berk-Tek, Essex, Belden, Lucent
3. The wire provided for all security monitoring sensors shall be 2 pair #22 for point sensors and 4 pair #22 plus 1 pair #20 for powered motion sensors.
   a. Recommended suppliers: West Penn, Belden, Atlas, Mohawk
4. The wire provided for all security camera locations shall be RG58/U coaxial cable with 100% shield or fiber optic cabling. power cabling for cameras shall be #18 Ga. min.

cabled constriction. All cabling below grade shall be rated for the application.

a. Recommended suppliers: West Penn, Belden, Atlas, Mohawk

2.2 CABLING SPECIFICATION

A. STATION WIRING-DATA

1. The wire provided for all data outlets shall be one 4-pair STP Category 6A cable per jack, UON.
   a. The Category 6A, 4-pair UTP cable, must be Performance Level Tested. Each 1000' spool must be individually tested with test results affixed.

B. DROP CABLE SPECIFICATION

1. All data drop cabling shall be EIA/TIA 568, 569 and TSB-36 Category 6 certified.
2. All data drop cabling shall be 4-pair shielded twisted pair, PVC rated (OSP rated for underground use), Category 6A certified cable. Untwisted cable shall not be used. This includes even short pieces of flat cable for jumpers, etc.
3. All data drop cabling shall also be guaranteed by the cable manufacturer to support data rates to 1Ghz. The bidder must include in writing in the form of press release, newsletter, or cut sheet verification of cable capabilities.

C. STATION WIRING- VOICE

1. The wire provided for all voice outlets shall be one 4-pair STP Category 6A cable per jack, UON.
   a. The Category 6A, 4-pair UTP cable, must be Performance Level Tested. Each 1000' spool must be individually tested with test results affixed.
2. DROP CABLE SPECIFICATION
   a. All voice drop cabling shall be EIA/TIA 568, 569 and TSB-36 Category 6A certified.
   b. All voice drop cabling shall be 4-pair shielded twisted pair, PVC rated (OSP rated for underground use), Category 6A certified cable. Untwisted cable shall not be used. This includes even short pieces of flat cable for jumpers, etc.
   c. All voice drop cabling shall be 24 AWG shielded twisted pair cable. All cabling for a single copper conductor shall have a maximum DC resistance of 28.6 ohms per 1000 feet at 20 degrees Celsius. All cabling shall have a maximum DC resistance unbalanced of 5 percent. All cabling will have a maximum mutual capacitance of a pair of 17 picofarads per foot. All cabling shall have a maximum pair-to-ground capacitance unbalanced of 1000 picofarads per 1000 feet.
   d. All voice drop cabling shall have an impedance (ohms) of the following values:

0.064	125±15%
0.128	115±15%
0.256	110±15%
772 kHz	102 + 15%
1.0-100.0 MHz	100 + 15%

a)

b)

c)

   e. All voice drop cabling shall have a maximum attenuation (dB per 1000 feet at 20 degrees Celsius) of the following values:

1.0 MHz	2.0
4.0 MHz	4.1
8.0 MHz	5.8
10.0 MHz	6.5
16.0 MHz	8.2
20.0 MHz	9.3
25.0 MHz	10.4
31.25 MHz	11.7
62.5 MHz	17.0
100.0 MHz	22.0
155.0 MHz	28.1
200.0 MHz	32.4
310.0 MHz	41.8
350.0 MHz	44.9

f. All voice drop cabling shall have a minimum Near-End Crosstalk coupling loss for any pair combination at 20 degrees Celsius shall be greater than the value determined by using the following formula for all frequencies in the range of:
   0.772 MHz to 100MHz for a length of 1000 feet:
   NEXT (F) > NEXT (0.772) - 15 log (F/O.772)

g. All voice drop cabling shall also be guaranteed by the cable manufacturer to support data rates to 350Mhz. The bidder must include in writing in the form of press release, newsletter, or cut sheet verification of cable capabilities.

h. Provide components consistent with the quality of KRONE part number TN5ETR-BLRB (blue) or approved equal, UL Subject 444, (UL)-C(UL) Type MPR/CMR/CMG, ICEA S-90-661, NEC 800 Type CMR TIA/EIA-568-A Cat 5 Horizontal Cable Requirements, ISO/IEC 11801 Category 5, TIA/EIA-568-A-5 Cat 5e Enhanced Horizontal Cable Requirements certified.

2.3 STATION HARDWARE-DATA

A. Flush mount jacks shall be high quality Category 6A, 8-position modular jack with twisted lead-frame construction and 110 style terminations terminated with a high impact 110 termination tool. Jacks shall provide dual color code to allow both T568A and T568B wiring on the same jack, and shall provide a cutting ledge to automatically trim wires during termination. Jacks shall meet TIA/EIA-568-A requirements for Category 6A connecting hardware as manufactured by KRONE or Avaya.

B. Faceplates shall match manufacturer for 8-position modular jack outlets at all locations.

C. All data connecting hardware shall be EIA/TIA TSB-40 Category 6A certified.

D. All data connecting hardware shall be modular jack panels with RJ45 jacks on the front and 110 style insulation displacement connectors (IDC) for termination of drop cable on the back.

E. All modular jacks shall be eight position jacks with pin/pair assignments utilizing EIA/TIA T568B.

F. All modular jacks shall be made continuous to the B-pin modular jack via a printed wiring board interconnection.

G. The connecting blocks shall be KRONE IDC style or approved equal.

H. The outlets faceplates shall be KRONE or approved equal in 4-6-8 port configurations. Supply 1 - 8 conductor modular data jacks and cables as a minimum per location.

2.4 STATION HARDWARE-VOICE

A. Flush mount jacks shall be high quality Category 6A, 8-position modular jack with twisted leadframe construction and 110 style terminations terminated with a high impact 110 termination tool. Jacks shall provide dual color code to allow both T568A and T568B wiring on the same jack, and shall provide a cutting ledge to automatically trim wires during termination. Jacks shall meet TIA/EIA-568-A requirements for Category 6A connecting hardware as manufactured by KRONE.

B. Faceplates shall match manufacturer for 8-position modular jack outlets at all locations.

C. All voice connecting hardware shall be EIA/TIA TSB-40 Category 6A certified.

D. All wiring voice connecting hardware shall be modular jack panels with RJ45 jacks on the front and 110 style insulation displacement connectors (IDC) for termination of drop cable on the back.

E. All modular jacks shall be eight position jacks with pin/pair assignments utilizing EIA/TIA T568B.

1.0Mhz	0.1
4.0	0.1
8.0	0.1
10.0	0.1
16	0.2
20	0.2
25	0.2
31.25	0.2
62.5	0.3
100	0.4

F. All modular jacks shall have a maximum attenuation corresponding with the table below. They shall approximate value of an equivalent of a 2 meter cable of the same category or any pair within a connector of the following values:

G. All modular jacks shall have a maximum NEXT corresponding with the table below:

1.0Mhz	>65
4.0	>65
8.0	62
10.0	60
16	56
20	54
25	52
31.25	50
62.5	44
100	40

H. The connecting blocks shall be KRONE IDC style or approved equal.

I. The outlets faceplates shall be KRONE or approved equal in 4-6-8 port configurations. Supply 1 - 8 conductor modular data jacks and cables as a minimum per location.

2.5 MC(MDF) /IC (IDF) /HC STATION TERMINATION HARDWARE-DATA & VOICE

A. Patch Panels
   1. Category 6A STP Termination Hardware. The Category 6A data station cable shall be terminated on Category 6A STP, 8-position modular jack patchpanels with circuit board construction in all IC/MC locations. The panels will have rolled upper and lower edges for rigidity and will provide front and rear side labeling visible after the cables and cords are installed. The 8-position modular jack patch panels shall be either wall mounted or rack mounted with cable management panels per communication detail sheets. The contractor is responsible for all wall brackets, patch panels, and cable management panels for all IC/MC/HC layouts and equipment rack configurations.
   2. Products: Category 6A STP patch panels (T568B wired, TIA/EIA-568).
   3. Cable management brackets must be provided at each rear section of the patch panel to facilitate cable routing and maintain proper bend radius of cables leading to the termination point.
      a. Recommended Product: Krone
   4. Cord or Patch Cable Manager: The cord manager shall have five (5) rings and provide the capability to organize and contain up to forty-eight (48) patch cords on the front of the panel. The front of the panel shall provide five (5) high capacity 1.5" x 4" horizontal distribution rings to reduce stress on stored cables to retain optimal cable geometry. All distribution rings shall have radiused edges to protect cables from nicks and tears. The cable manager shall be a minimum of two (2) RU high, and shall fit a standard 19" EIA rack rails.
   5. Provide patch panels as required to terminate all indicated station outlets as shown on the project drawings.
   6. Patch panels shall be provided at all EER locations indicated.
   7. Supply patch panels in rack mount versions with a minimum of 24-32\ports.
   8. The patch panels shall exhibit the following minimum characteristics:
      a. EIA 19” rack mountable
      b. 110 rear termination
      c. Modular jacks are circuit board mounted
      d. supports 568A and 568 wiring
      e. removable front labels
      f. requires 3.0” rack space. min.
   9. The patch panel shall meet TSB-40 standards.
   10. Supply patch panel with full compliment of CAT-6A data patch cables. CAT-6A patch cables shall be configured as follows:
      a. Color: Yellow
      b. 24,36,48,60 & 72” in length
      c. RJ45 each end with strain relief boots
      d. stranded copper wire
   11. Acceptable vendors for patch panels which are pre-approved for this project are:
      a. KRONE

2.6 MC(MDF) /IC (IDF) /HC TERMINATION HARDWARE-VOICE TRUNK CABLING

A. Main Cross Connect Base
   1. The cross-connect shall provide Category 6A compliant 110 termination capable of supporting voice, security, and Category 6A data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The 110 panels shall mount to walls or backboards in a mounting-frame style unit, which

provides additional cable access and horizontal cord management. The units shall be UL listed, CSA certified, TIA/EIA-568-A and Category 6A compliant, and made in the USA. The mounting frames shall support up to three 100-pair wiring bases, with the capability to accept extension units to create higher densities of up to 900 pairs per tower. The mounting frames shall be made of 16 gauge steel; wiring bases and blocks shall be made of fire-retardant plastic rated UL 94V-0, with provision for TIA/EIA-606 compliant labeling. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

B. Main Cross Connect Extension
   1. The cross-connect shall provide Category 6A compliant 110 termination capable of supporting voice, security, and Category 6A data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The 110 panels shall mount to walls or backboards in a mounting-frame style unit, which provides additional cable access and horizontal cord management. The units shall be UL listed, CSA certified, TIA/EIA-568-A and Category 6A compliant, and made in the USA. The mounting frames shall support up to three 100-pair wiring bases, with the capability to accept extension units to create higher densities of up to 900 pairs per tower. The mounting frames shall be made of 16 gauge steel; wiring bases and blocks shall be made of fire-retardant plastic rated UL 94V-0, with provision for TIA/EIA-606 compliant labeling. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

C. 100 Pair IDC 110 Terminations
   1. The cross-connect shall provide Category 6A compliant 110 termination capable of supporting voice, security, and Category 6A data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The 110 panels shall mount to 19” distribution frame or hinged wall mount bracket. They shall be UL listed, CSA certified, TIA/EIA-568-A and Category 6A compliant, and made in the USA. Panels shall support 100, 200 or 300 pair densities with provision for TIA/EIA-606 compliant labeling, and be made of 16 gauge steel, with bases and blocks made of fire-retardant plastic rated UL 94V-0. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

D. Horizontal Cord Manager
   1. The horizontal 110 cord managers shall mount to a wall or backboard, or onto 300 pair mounting-frame basic or extension units, providing the capability to organize and contain patch cords between rack mount 110 wiring bases. The cord managers shall comply with TIA/EIA-568-A and -606 requirements, and be made of fire-retardant plastic rated UL 94V-0. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

E. 110 Connector Blocks
   1. The 110 connector blocks shall support termination for voice, security, and Category 6 data applications, including high megabit and shared-sheath applications when used with Power Sum rated cabling. The blocks shall be Category 6 compliant, UL listed, CSA certified, and TIA/EIA-568-A compliant. They shall be made of fire-retardant UL 94V 0 plastic with solder-plated insulation displacement connectors, and must

securely seat wires on 110 wiring bases, providing a gas-tight IDC connection that can withstand 200 reterminations. A one-year limited product warranty and a 15-year performance guarantee shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.

F. 110 Patch Cords and Plug Assemblies
1. Provide 110 Patch Cord and Plug Assemblies and patching cables as needed to cross connect all cabled stations/ports in system. Supply compliment of various length cables to cross connect as required.
2. Provide spares as follows:
   a. 10 - 36”
   b. 10 - 48”
   c. 10 - 60”
   d. 10 - 72”
   e. 10 - 84”

2.7 DATA DISTRIBUTION EQUIPMENT RACK

A. Provide equipment racks and/or frames in locations indicated on the drawings. Racks shall be equipped as detailed on the drawings and as hereafter specified.

B. MC/IC/HC locations provide IMRAK 7' tall equipment racks (or as indicated), or equivalent.

C. FREE STANDING CABINETS:
1. Provide 19” or 24” EIA floor mount cabinets with bracing brackets and floor mounting accessories as required to support cabling infrastructure with 19” EIA patch panels, data switches and light interface guides along with ancillary equipment.
2. Provide IMRAK 1400 or ZERO XA series as manufactured by VERO ELECTRONICS or pre-approved equal.
3. The cabinet shall incorporate a Plexiglas, locking front door assembly and solid rear door with lock.
4. Provide with required horizontal and vertical cable management for all racks/cabinets, panels and hardware as required to facilitate complete installation.

D. Jumper Management Panels
1. The rack mount hardware shall incorporate in-rack and interbay jumper management techniques. One or both methods may be used as required. In-rack management panels shall be available to provide jumper storage and routing to the connector housings and electronic switches. Additionally, in-rack panels are required for installations where interbay storage methods are not feasible (i.e. already installed lineup where footprints are already specified). Interbay storage is recommended for large slack storage requirements and multiple out of bay patching.
2. In-Rack jumper management panels shall be available in 1-RMS, 2-RMS and 3-RMS sizes and shall have removable front covers to conceal and protect the jumpers when installation is complete. The front of the jumper management panel cover shall be flush with the front door of the connector housing.
3. Jumper management panels shall be designed to maintain a 1.5 inch minimum bend radius when transitioning between routing panels and frame verticals or connector housings and shall be finished with a wrinkled black powder coat for durability. All fasteners shall be black chromated to match the housing.
4. The vertical jumper routing area shall have vertically adjustable cable retaining rings. The adjustable routing rings shall include a swing out door for ease in jumper routing. The sides of the adjustable routing rings shall have radius guides to provide minimum bend radius control. The rear side of the vertical routing area shall also provide cable

retaining rings that hold data and power cables close to the rack to eliminate accidental snags from maintenance personnel.

5. Slack storage spools shall be provided when jumper slack storage is required in-rack.
6. Slack storage shall be available using both in frame and interbay storage panels. The storage panels shall be functional both individually and combined.
7. The Interbay Storage panel shall provide both front and rear jumper routing distribution and storage. The interbay storage panel shall be designed to integrate with an EIA standard 7 foot tall equipment rack. The interbay panel shall have a footprint of 6 inches in width and shall have a removable cover that is flush with the front doors of the connector housings when installed. The panel shall be finished with a wrinkled black powder coat for durability. All fasteners shall be black chromated to match the housings.
8. Wall-mountable hardware shall have a means to transition between the connector housing and cable trough or tray.

E. Distribution Rack Grounding: Provide grounding kit similar to IBM Part # 4716804 for each IC and MC. Rack shall be grounded using stranded # 6 AWG insulated copper conductor. Provide all required bonding material and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

2.8 UNDERGROUND VOICE TRUNK CABLING

A. GENERAL
1. Underground voice trunk cabling shall be installed as indicated on the contract drawings and as called for in these specifications.
2. All UTP voice trunk cabling shall be installed in underground conduit and manhole infrastructure without splicing.
3. The trunk cabling shall be installed free of defects and in accordance with AT&T outside plant installation manuals.
4. The cabling shall exhibit the following properties:
   a. 6,12,25,50,100,200 pair configurations
   b. PIC ALPETH Filled FOAM SKIN “DEPIC”
   c. RE-89 Listed
   d. FlexGel filling compound
   e. Electrical properties:
      1) Mutual Capacitance - nF per mile = 83 +/-4
      2) Unbalanced Capacitance - pF per 1000’ = 100
      3) Pair to Ground Capacitance - pF per 1000’ = 800
      4) DC Conductor Resistance - ohms per 1000’ = 27.5
      5) Resistance Unbalance - 1.5 ohms
      6) Min. Dielectric Strength (kV) = 3.0
      7) Insulation Resistance - megohm per mile = 10,000
      8) Nominal Attenuation - dB per mile = 13.4
      9) Far End Crosstalk - dB per 1000’ = 73
      10) Near End Crosstalk - dB per 1000’ – 66

2.9 FIBER OPTIC CABLE SPECIFICATIONS

A. BACKBONE CABLING FIBER OPTIC CABLE PLANT
1. Outdoor Tight Buffered Hybrid Fiber Optic Cable
   a. Outdoor Cable is designed for backbone interbuilding (outside plant) applications. The cable shall be designed for use outdoors and provide excellent protection from the elements.
   b. The cable shall meet the requirements of the National Electrical Code, Article 770,

TIA/EIA 568A “Commercial Building Telecommunications Wiring Standard”, ICEA-83-596-1988 Insulated Cable Engineers Association Standard for Fiber Optic Premises Distribution Cable Publication S-83-596, December 1988, ANSI X3.166-1990 Fiber Data Distributed Interface (FDDI), Token Ring Physical Layer Medium Dependent (PMD), and a combination of Bellcore Generic Requirements for Optical Fiber and Fiber Optic Cable (GR-20-CORE)

c. A tight buffered construction shall be used. The cable shall be constructed Core Locked indoor/outdoor PVC out jacket. The fillers, if used, shall be combined and covered with a medium density jacket to provide excellent environmental protection.

2. Multimode Fibers (24 per cable)
   a. Multimode fibers in the cable shall contain 50 micron graded index multimode fibers. These fibers are located inside the buffer tubes. Multimode fibers shall meet the specifications defined by the Multimode Optical Fiber Specifications.
   b. Fiber Identification
      1) The fibers within each buffer tube shall be distinguishable from each other by means of color coding. The color coding sequence shall be blue, orange, green, brown, slate, white, red, black, yellow, violet, rose and aqua.
   c. Stranding member using a reverse oscillating lay (SZ) stranding method with counter helically applied non-hydroscopic binder tapes.
3. Single Mode Fibers (12 per cable)
   a. Single Mode Fibers in the cable shall contain 9 micron graded index multimode fibers. These fibers are located inside the buffer tubes. Single mode fibers shall meet the specifications defined by the Single Mode Optical Fiber Specifications.
   b. Fiber Identification
      1) The fibers within each buffer tube shall be distinguishable from each other by means of color coding. The color coding sequence shall be blue, orange, green, brown, slate, white, red, black, yellow, violet, rose and aqua.
   c. Stranding member using a reverse oscillating lay (SZ) stranding method with counter helically applied non-hydroscopic binder tapes.
4. Strength Member
   a. The primary strength member shall consist of aramid yarns applied around the fibers.
5. Cable Jacket
   a. A black jacket made of medium density polyethylene (MDPE) shall be extruded around the cable core and aramid yarn. The jacket shall have two co-extruded tracer stripes located 180° apart for identification. The tracers shall be MDPE jacket material.
   b. The cable jacket shall be designed for easy removal, with readily available tools. The design shall permit jacket removal without damage to the optical fibers.
   c. The cable jacket shall be printed with manufacturer name, sequential length marking, the number and type of fiber and the appropriate cable type marking according to NEC Section 770.
6. Minimum Bend Radius
   a. The minimum static bend radius shall be 10 times the cable outside diameter. The minimum dynamic bend radius shall be 20 times the cable outside diameter.
   b. The average increase in attenuation shall not be greater than specified by GR 20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.
7. Impact Resistance
   a. The average increase in attenuation shall not be greater than specified by GR-20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.
   b. Testing shall be done in accordance with EIA-455-25A (Impact Testing of Fiber Optic Cables and Cable Assemblies). Optical Attenuation chances shall be measured following the procedures of EIA-455-20 (Measurement of Change in

Optical Transmittance). The cable specimen shall be subjected to 25 impacts of 4.3 N.M.

8. Compressive Strength
   a. A representative sample of the cable shall withstand a minimum compressive load of 440 N/mm (250 lbf/in) for armored cable, and 220 N/cm (125 lbf/in) for nonarmored cable applied uniformly over the length to the compression plate.
   b. The average increase in attenuation shall not be greater than specified by GR- 20-CORE depending on the type of fiber used, single-mode or multimode.
   c. Testing shall be done in accordance with EIA-455-41 (Compressive Loading Resistance of Fiber Optic Cable).
9. Tensile Strength
   a. The average increase in attenuation at the rated tensile load of the cable shall not exceed than specified by GR-20-CORE depending on the type of fiber used, single-mode or multimode.
   b. The maximum dynamic (short term) tensile load rating will be 600 lbs. (2700 Newton's). The maximum static (long term) tensile load rating shall be 135 lbs. (600 Newton's).
   c. Testing shall be done in accordance with EIA-455-33A (Fiber Optic Cable Tensile Loading and Bending Test).
10. Cable Twist
    a. The average increase in attenuation shall not be greater than specified by GR 20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.
    b. Testing shall be done in accordance with EIA-455-85 (Fiber Optic Cable Twist Test). The test length (L) shall be a maximum of 4 meters.
11. Cable Cycling Flexing
    a. The average increase in attenuation shall not be greater than specified by GR 20-CORE depending on the type of fiber used, single-mode or multimode. No mechanical damage shall occur to the cable jacket.
    b. Testing shall be performed in accordance with EIA-455-104 (Fiber Optic Cable Cyclic Test). The cable shall be flexed for 25 cycles at 30 cycles/minute.
12. Outer Jacket Yield Strength
    a. The yield strength and ultimate elongation of the outer cable jacket shall be tested in accordance with EIA-455-89A (Fiber Optic Cable Jacket Elongation and Tensile Strength).
13. Jacket Shrinkage
    a. The maximum cable jacket shrink back shall be less than 5%.
    b. Testing shall be done in accordance with EIA-455-86 (Fiber Optic Cable Jacket Shrinkage).
14. Temperature
    a. The cable shall maintain optical and mechanical integrity over the following temperature ranges:
       1) Operation:-40° C to +85° C
       2) Installation-40° C to +70° C
       3) Storage:-40° C to +75° C
15. Cable Reels
    a. The cable shall be shipped on non-returnable wooden reels designed to prevent damage to the cable during shipment and installation. Wooden lagging boards will be fastened across the reel flanges.
    b. Each reel should be clearly marked to indicate the direction in which it should be unrolled to prevent loosening of the cable on the reel.
16. Reel Covering
    a. A covering shall be placed between the flanges over the exposed cable. The covering shall be weather resistance and shall limit solar heating of the cable.
    b. The cable ends shall be securely fastened. The end attachments shall prevent the escape of any filling compound and shall prevent the entry of moisture.

17. Reel Identification
    a. Each reel of cable shall be stenciled or have a data sheet attached (Packaged in a waterproof wrapping) containing the following information:
        1) Reel identification number
        2) Measured attenuation of cable
        3) Length of Cable
18. Quality Control
    a. Each master reel shall be tested to ensure fiber integrity, attenuation, and cable length. Multimode fibers shall be tested at both 850 and 1300 NM. Single mode fibers shall be tested at both 1300 and 550 NM. Each master reel will be given a unique identification and the test results documented. The manufacturer shall maintain documentation such that the cable history may be traced to the individual fibers used in construction of the cable.
19. Test Report
    a. A test report shall be included with each reel of cable. This test report will include the cable description, unique reel identification, measured length of the cable in meters and feet, attenuation measurements at wavelengths tested and the manufacturer name and address.
20. Provide components consistent with the quality of Optical Cable Corporation DX Series certified.

2.10 FIBER OPTIC CABLE TERMINATIONS

A. Fiber Optic Cable shall be installed in innerduct. Outside gel filled fiber cable shall be installed in conduit or UL approved plenum innerduct. Non-riser rated gel filled cable must be terminated within 50' of building entrance per BICSI Standards.

B. Terminations shall be performed by a manufacturer trained and certified technician for optical fiber connections.

C. Fiber Optic connectors shall be:
1. SC connectors for all single mode terminations.
2. ST connectors for all multimode terminations.

D. Fiber Optic couplings shall be as provided by on in fiber patch panels and shall be either multi-mode or single mode ST as required for the application.

E. Terminations shall be made in a controlled environment. The contractor may choose to have the cables assembled off-site, although testing must be completed with the cable in its final installed condition.

2.11 DATA-MC/DATA-IC/DATA-HC FIBER OPTIC CABLE TERMINATIONS

A. Optical Fiber Connectors.
1. Products: 3M Corporation, AMP or Lucent ST connectors.
2. Optical Fiber Termination Enclosures used in the DATA-MC/DATA- IC/DATA-HC rooms shall provide termination panels for ST or SC type connectors and be of sufficient size and capacity to terminate 100% of the fiber count of the inside or outside fiber optic cables. Patch panels must be wall or 19" rack mountable depending on IC/MC/HC applications. Provide all termination accessories, enclosures, and testing for a complete fiber optic distribution system.
    a. Products: KRONE 36 port panels

B. Optical Fiber Patch Panels
   1. The patch panel shall provide 36 fiber couplings in 3.0" of vertical rack space. These couplings shall be pre-installed in a single bulkhead. The patch panel shall have removable front and rear doors as well as a removable lid. There shall be vertical and horizontal ingress/egress features in the form of slots in the top, bottom and sides of the panel, both front and rear. All ingress/egress slots shall be covered with a self-adhesive UL 94V-0 rated grommet material. All ingress/egress slots shall have a strain relief post with a slot capable of holding a tie wrap. The panel shall provide strain relief in the form of a grounding lug and multiple tie-wrap points. The panel must have mounting ears that allow mounting on 19" or 23" hole centers in either a mid- or flush-mount configuration. The panel shall have dual, adjustable plastic cable management rings made of high impact UL 94V-0 rated self-extinguishing plastic. The patch panel shall be capable of having a slide feature attached to it to allow the entire box to be moved in and out of the rack. A port identification label/card shall be provided. The panel shall be made of 16 gauge steel, painted black. A one-year limited warranty shall be provided by the manufacturer. A lifetime warranty against defects in material and workmanship shall be provided by the manufacturer for this unit when it is installed in a certified system.
   2. Approved Supplier: KRONE

PART 3 EXECUTION

3.1 GENERAL

A. The contractor shall avoid penetration of fire-rated walls. Sleeving shall be installed for access where necessary.

B. Any penetration through fire rated walls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant. Use 3M Firestop material. Contractor shall also seal all floor, ceiling, and wall penetrations in fire or smoke barriers and in the MC, IC's and wiring closets.

C. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
   1. Recommended Products:
      a. Twisted-pair cable: Dyna-Blue, American Polywater.
      b. Optical fiber cable: Optic-Lube, Ideal

D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 lbs.

E. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

F. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over twisted pairs at terminals, and sheath removed too far (over 2").

G. All cable shall be continuous and splice-free for the entire length of run between designated MDF, IDF, pull boxes or terminations.

H. Terminate all cable in designated MDF,IDF,Jacks and/or designated equipment backboards. No terminations or splices shall be permitted in pull boxes, underground or any non-

designated termination point.

I. Provide service loop of cables at all junction and termination cabinets or boxes and backboards.

J. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system.

K. Provide identification labels on each cable ends, backboard, wall jack and installation log in accordance with EIA/TIA 606. Cable labels shall be imprinted or type written style and shall be attached in a manner as to allow easy viewing along the length of the wire/cable. Acceptable systems are PANDUIT, BURNDY or approved equal. Submit to Consultant for approval of method.

L. Provide installation logs supporting building infrastructure.

M. Dress or harness all wire and cable to prevent mechanical stress of electrical connectors. No wire or cable shall be supported by a connection point. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.

N. Configure and cross connect all ports as required for complete end to end system.

O. Strap or secure cables every 5 feet. Do not strap to lighting, ceiling grid, etc.

P. Cables shall be routed in corridors whenever possible to avoid unencumbered access to cables.

Q. Cables shall be placed as a minimum of 12” from 208-240VAC power and 18” from 480 power.

R. Maintain 18” clearance between light fixtures incorporating ballast operation.

S. Cables shall be installed to preclude damage and not come in contact with sharp edges of building, wireways or casework/furniture.

T. Maintain minimum bend radius per drawing details.

U. Cables shall be a minimum of 30” from heating, steam valves etc.

V. All conduits shall have bushings in place prior to cable installation.

W. All installation shall be coordinated with Consultant for Milestone verification.

3.2 LABELS

A. The labeling plan shall be developed by the Contractor and approved by owner.The Contractor will label all outlets following the detailed shop drawing design, using permanent/legible typed or machine engraved labels approved by owner. Terminals in the HC's/IC's/MC's shall be labeled by the contractor using designation strips designed for 110 hardware or as applicable to terminal hardware. All copper/fiber terminal for riser cables in the HC and/or IC shall correspond to terminal numbering in the MC.

B. The labels on HC/IC station terminal blocks shall be numerically sequential. Outlets shall be labeled to match the labels on the corresponding terminal block position. Labels shall

include a room number component and a sequential extension. The room number component shall reflect the numbering system utilized for existing door labels or room numbers as selected by owner. For example, the third outlet in room 25 (starting on the left side of the door and working clockwise around the room) is labeled: "25.3."

C. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

D. All labels shall correspond to as-built and to final test reports.

3.3 STATION WIRING INSTALLATION

A. The low voltage Contractor's RCDD shall supervise the installation of communications cable. All Category 6A and Fiber Optic cable shall be installed by individuals trained in low voltage data cable system installation. All Category 6A (4) pair STP cable must be handled with care during installation so as not to change performance specifications. The Contractor shall not over-tighten tie wraps or over-bend the Category 6A STP cable.

B. Exposed station wire will only be run with owner approval. Approval will be granted only when no other option exists. When station wire must be run surface to a single outlet, surface raceway shall be used to cover the cable.

C. All wiring and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All wiring and associated hardware shall be placed so as not to impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing). All wiring, and associated support structures and hardware shall be placed so as not to impair owner's efficient use of their full capacity.

D. All wiring placed in ceiling areas must be tied or clamped. When wire is placed in ceiling areas or other non-exposed areas, fasteners shall be placed at intervals no greater than 60" and preferably on 48" centers. Cable sag between supports shall not exceed 12". Attaching wire to pipes or other mechanical items is not permitted. At all runs of twenty or more cables, provide rings at 60" (maximum) centers to hang cable. Communications cable shall be routed to avoid light fixtures (18" minimum spacing), sources of heat (12" minimum spacing) and power feeder conduits (12" minimum spacing). Communications cabling must be spaced a minimum of 120" (10') from bus duct.

3.4 STATION HARDWARE

A. Eight (8)-position modular jack pin assignments:

B. Pin connections for data station 8-position modular jacks and patch panels shall match TIA/EIA-568-A modular jack recommendation T568B that is both 10/100BaseT compatible.

C. Pin connections at data jack panels shall match pin connections at outlets with straight through wiring.

D. Terminations at telephone terminal blocks (where required to maintain existing station cable) shall match following pair sequence for T568B:
   1. Pair 1, Pins 5 and 4, White-Blue, Blue (/White).
   2. Pair 2, Pins 1 and 2, White-Orange, Orange (/White).
   3. Pair 3, Pins 3 and 6, White-Green, Green (/White).
   4. Pair 4, Pins 7 and 8, White-Brown, Brown (/White).

3.5 BACKBOARD CABLING/EQUIPMENT RACK CONFIGURATION

A. Cable installation in the Entrance Room and Communications Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment mounting access hatches to air filters, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings. Provide a minimum of 36" for a service loop to the patch panel.

B. Cable shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.

C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace or tie-clamp all similarly routed cables together, and attach by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.

D. Do not over-tighten cable ties or binding on Category 6A station cable. Observe Category 5e cable bend radius.

3.6 PROTECTION OF WORK SPACE AND AREA - SITE SAFETY

A. SIGNS, BARRICADES, MARKING TAPE
   1. Always protect open and confined spaces with standard construction guards and warning devices.
   2. Place approved warning lights or reflector signs near areas where work is performed below grade in vaults or manholes. Area shall be barricaded to prevent staff access to work area. Warning lights, barricades and signs shall be placed:
      a. One-half hour before sunset or anytime vision is impaired by fog, haze, etc.
      b. Signs and lights must remain in place until the work is completed.
      c. When below grade work is being performed and work area is left uncovered and unattended, the contractor shall place warning signs with flags, boundary warning tape and cones in the direction of approaching pedestrian or vehicle traffic.
      d. When work is located near a curve in walkway/roadway or near a top of hill, place additional warning devices to give sufficient warning to approaching pedestrian or vehicular traffic.
      e. Work located in public or private intersections, on public or private surface streets or where traffic is heavy additional precautions shall be deemed necessary and the contractor is to provide for public and staff safety at all times.
   3. Materials, tools, vehicles and equipment shall be placed and positioned to cause minimal interference with traffic. Materials, tools, vehicles and equipment shall be configured and arranged on the site and in the work area to minimize hazards to traffic, staff or personnel.
   4. Provide protection around all pull lines and/or cable.
   5. When equipment, vehicles, tools, materials must be left at the site, unattended, it shall not be secured to posts, poles, furniture, buildings, fencing, or fire hydrants.

B. WORK SPACE BELOW GRADE

1. Confined spaces below grade (manholes, handholes, vaults, tunnels, etc.) are required to be tested for hazardous gas prior to entering. Confined spaces shall not be entered until LOCAL SAFETY procedures have been followed to entering below grade work space.
2. If a hazardous substance is detected in the confined work space, the contractor shall immediately notify owner and consultant and the appropriate gas utility company.
3. Report all trapped or unconscious victims to 9-1-1 and owner.
4. Open flame of any type is not allowed into below grade or confined work spaces.
5. Below grade work spaces shall be ventilated in accordance with LOCAL SAFETY guidelines prior to commencement of work.
6. Use only approved lighting in below grade/confined work spaces.
7. Contractor shall take extreme caution and care while working in existing below guard confined spaces to prevent damage to existing lines, wires, cables, circuits, etc.

C. WORK SPACE ABOVE GRADE
1. Contractor shall protect work area as defined in SIGNS, BARRICADES and MARKING TAPE.

3.7 INSPECTION

A. Conformance to the installer practices covered above are to be verified when completed. In some cases, the customer may inspect before acceptance. The following points are to be examined:
1. Is the design documentation complete?
2. Have all terminated cables been tested per the specifications?
3. Is the cable type suitable for its pathway?
4. Have the pathway manufacturer's guidelines been followed?
5. Have the installers avoided excessive cable bending?
6. Have potential EMI sources been considered?
7. Is cable fill correct?
8. Are hanging supports within 60" (5')?
9. Does hanging cable exhibit some sag?
10. Are telecommunications closet terminations compatible with applications equipment?
11. Have station jack instructions been followed?
    a. Jacket removal point.
    b. Termination positions.
    c. Pair terminations tight with minimal pair distortions.
    d. Twists maintained up to termination.
12. Have patch panel instructions been followed?
    a. Cable dressing first.
    b. Jackets remain up to the connecting block.
    c. Pair terminations tight and undistorted.
    d. Twists maintained up to the connecting block.
13. Are the correct outlet connectors used (568B)?
14. Is the jacket stripped back only as much as is needed, not to exceed 2" from the connection?

3.8 QUALITY CONTROL

A. Evidence of Experience and Qualifications
1. Show that the installer who will perform the work has a minimum of 5 years experience successfully installing system of the same type and design as specified herein. Include the names, locations, and points of contact of at least two similar installations of the same type and design as specified herein where the installer has installed such

systems. Indicate the type of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 12 months.

2. Show that the instructor, who will train staff, operating and maintenance personnel, has received a minimum of a CNE/MCE training from a factory training center, and 2 years experience in the installation of systems of the type specified. Submit training certification in equipment submittals, title section training and certifications.

3.9 INSTALLATION TESTING

A. SYSTEM TESTING REQUIREMENTS-STATION

1. Owner/Consultant shall be notified one week prior to any testing so that the testing may be witnessed.
2. Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable for fiber optic and all copper plant wiring.
3. Acceptance of the simple test procedures discussed below is predicated on the Contractor's use of the recommended products (including but not limited to twisted pair cable, cross-connect blocks, and outlet devices specified in the Products paragraph) and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
4. At a minimum, the Contractor shall test:
   a. All station drop cable pairs from HC/IC/MC termination patch panels to outlet device 8-position modular jacks.
   b. Each wire/pair shall be tested at both ends for the following (utilizing the attached test results forms):
      1) Termination order.
      2) Polarity (pair reversals).
      3) Continuity.
      4) Shorts.
      5) Grounds.
      6) NEXT (near end crosstalk) from both directions.
      7) Cable length (record all length).
      8) Wire Map
      9) Length
      10) Impedance
      11) Resistance
      12) Capacitance
      13) Attenuation
      14) Active ACR
      15) INJ NEXT Loss
      16) INJ Active ACR
   c. Testing shall be made utilizing a hand cable tester as manufactured by Fluke, Microtest or Wavetek.
   d. All test equipment shall bear current calibration stickers or dated certificates.
   e. Printed test results along with as-built drawings shall be assembled into a 3-ring project binder and delivered to the Consultant for verification and acceptance.
5. When errors are found, the source of each error shall be determined, corrected, and the cable re-tested. All defective components shall be replaced and retested. Defective components not corrected shall be reported to owner/consultant with explanations of the corrective actions attempted.
6. Test records shall be maintained using the test results forms outlined below. The form shall record closet number, riser pair number or outlet ID, outcome of test, indication of errors found (e.g., a, b, c, d, or e) cable length, re-test results after problem resolution and signature of the technician completing the tests. See Appendix to electrical

specifications for testing form.
7. Test results for each 4- pair, Category 6A, STP cable must be submitted with identification to match labels on all patch panel ports and 8-position modular jacks, and identification to match as-builts associated with that cable.
8. Owner will observe and verify the accuracy of test results submitted.

B. SYSTEM TESTING REQUIREMENTS - CABLE PLANT
1. All data drop cables shall be tested for continuity and polarity between station jack, IDF and MDF.
2. All data trunk cables shall be tested for continuity and polarity between
3. IDF and MDF, using a portable handheld Analyzer. Certify tests in writing.
4. All testing shall be performed in accordance with EIA/TIA building standards and shall be done in the presence of the Consultant.
5. Transmission measurements shall be taken at random to ensure overall system compliance. Tests shall be conducted as follows:
   a. Using a network analyzer, coax cables, baluns, UTP test leads and impedance matching terminations perform the following;
      1) refer to TIA/EIA/TSB-40
   b. Log all tests in acceptance testing manual. Record and document the following for each cable and circuit.
      1) Continuity
      2) Polarity
6. All testing equipment shall have current calibration stickers firmly affixed to the testing equipment. All calibrations shall be traceable to the National Standards Bureau.
7. Provide printed test data for CAT-6A certification for LAN service.
8. Testing shall be performed in the presence of owner and consultant.
9. Testing shall include verification of:
   a. Cable Plant

3.10 FIBER OPTIC TESTING SPECIFICATIONS

A. All testing shall be performed by trained personnel.

B. For all installed fiber optic cable EIA 455-171 Method D procedures will be adhered to. (Bi-directional).

C. Connector loss shall not exceed .5 dB per termination.

D. The fiber optic cable shall not exceed 1.5 db per kilometer tested at 1300 nm and 1500 nm for single mode cable.

E. The fiber optic cable shall not exceed 4 db per kilometer tested at 850 nm and 2 db per kilometer tested at 1300 nm for multimode 62.5/125 fiber.

F. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer's specifications.

PART 4 WARRANTY SERVICE & CLOSE OUT

4.1 MINIMUM WARRANTY

A. The cabling system shall meet the performance requirements of the ANSI/TIA/EIA-568-A standard (Annex E) and TIA/EIA Telecommunications Systems Bulletin 67. The warranty

on the material, services, and operation of the cabling system to this specification must be for a period of at least 15 years. The connecting hardware shall have a lifetime extended warranty against defects in material and workmanship.

B. The warranty must include the following statements regarding the cabling system:
   1. "Will support and conform to TIA/EIA-568-A specifications covering ANY CURRENT OR FUTURE APPLICATION which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or basic link performance as described in TIA/EIA-568-A AnnexE and TIA/EIA-TSB-67."
   2. "Will be free from defects in material or faulty workmanship"
   3. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance by Consultant.

4.2 COMMISSIONING

A. General
   1. Acceptance shall consist of the following:
      a. Burn-in period.
         1) The system shall be accepted for start of warranty upon successful completion and testing of the Consultant.
         2) Burn-in period shall be a 30-day time frame to allow the system to operate free of defects, grounds, programming faults, etc.
         3) The 30-day burn-in shall begin the day of acceptance by Consultant.
         4) The burn-in period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.
         5) Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification by owner’s personnel and correct said deficiencies.
         6) Upon correction and restoration, the burn-in period shall be re-set to “0” and the 30 day count shall begin again.
         7) Warranty shall commence upon day 31 of successful burn-in period.
      b. Final Test
         1) Before the installation shall be considered completed and acceptable by the awarding authority, a test on the system shall be performed as follows:
         2) The contractor's job foreman, in the presence of a representative of the manufacturer, and a representative of the owner shall operate every network device to ensure proper operation and correct configuration at the file server location.
         3) When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to owner.
         4) The contractor shall leave the data network system in proper working order, and, without additional expense to owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the Consultant.

4.3 PROJECT CLOSE OUT

A. Operating and Instruction Manuals
   1. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to owner upon completion.
   2. Provide necessary training and/or schooling to designated owner’s personnel at no

additional cost to owner. Training shall be at owner's designated location, by factory-trained personnel.

B. Testing Frequency Instructions
1. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a complete trouble-shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to owner upon completion of the system.
2. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
   a. Instruction on replacing any components of the system, including internal parts.
   b. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions
   c. A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.
   d. User operating instructions, shall be provided prominently displayed on a separate sheet located next to the control.
3. Owner shall be furnished with all programming disks for each installation as well as hard copy printouts. Provide necessary training and/or schooling to designated owner's personnel at no additional cost to owner. Training shall be at owner's designated location, by factory-trained personnel.
4. Staff of owner maintenance shall be thoroughly instructed in the use of the System. Training shall include a minimum of three (1) hour sessions, to be scheduled at owner's designated time.
5. Maintenance instruction shall be performed in the same manner as described above. Training shall include a minimum of three (1) hour sessions, to be scheduled at owner's designated time.

4.4 DRAWING DETAILS (AS-BUILTS)

A. Show wall elevation and wire details on shop drawings. Show equipment function, make and model and wire routing and terminations within rack or cabinet.

B. Show as-built location of all devices on as-built drawings.
1. Provide 3 sets of bound operation and maintenance manuals, including submittal materials, and record of field changes. Provide complete as-built wiring diagrams in AutoCAD R2000 format. Provide disk files and original tracings (E size) in format of construction drawings.

C. As-Built Drawings, Testing, and Maintenance Instructions
1. A complete set of reproducible as-built drawings in AutoCAD R2000 format (CDs and sheets) showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to owner upon completion of system acceptance.

END OF SECTION 26 47 50

SECTION 26 47 70 AUDIO/PAGING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. This section outlines a the requirement for supplying and installing the headend to the local paging/zoned paging system, capable of providing building paging, announcements, zoned background music and assistance with emergency evacuations.

1.2 WORK INCLUDED

A. Furnish a complete public address system headend including amplifiers, mixers, controllers, racks, conduit and wire.

1.3 DESCRIPTION

A. Public address system shall interface with telephone system to provide zone paging, as indicated into production, warehouse, lunch room, outdoor patio, lobby, cafeteria, fitness room and all call page areas.

B. The system shall be capable of adding quality background music to any or all page zones in the future.

1.4 SUBMITTALS

A. In addition to the requirements of Division 1, submit all materials for approval arranged in same order as specifications, individually referenced to specification paragraph and drawing number submit number required in Division 1 plus three (3) copies of A4 material and 2 prints plus one reproducible of drawings in A0 size, minimum. Submit A4 items bound in volumes and A0 drawings in edgebound sets. Originals only, no photo copies.

B. Progress Schedule: include duration and milestones for the following:
   1. All submittals specified.
   2. Completion of equipment buyout.
   3. Completion of equipment receipt at fabrication shop.
   4. Shop fabrication.
   5. Shop testing.
   6. Shipment to site.
   7. Installation.
   8. Field testing.
   9. Training.
   10. First use date.

C. Manufacturer's Product Data:
   1. List of Materials: For each item, include:

a. Specification section reference.
b. Manufacturer.
c. Model number.
d. Listing: VdS, EN, DIN, VDE or none.
e. Quantity.

D. Manufacturer's Product Data: in sequence of list of materials, data sheet for each item, including all accessories, marked for proposed product.

E. Field and Shop Drawings:

F. Resubmit: for coordination reference complete with corrections from previous submittal:
1. List of Materials.
2. Manufacturer's Product Data.

G. Field (installation) Drawings: Collate in sequence:
1. Drawing index/symbol sheet.
2. Floor plans. At scale of Contract Documents. Show:
   a. Devices with circuit number.
   b. Rough-in.
   c. Mounting height.
   d. Conduit size.
   e. Wire type.
   f. Wire fill.
   g. Sections/Elevations. At scale of Contract Documents.
      1) Mounting location reference.
   h. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:
      1) Refer to floor plans.
      2) Architectural features.
      3) Rack cabinets.
      4) System furniture.
      5) Clearances.
   i. System conduit riser drawing, show:
      1) Terminal cabinets.
      2) Coordination with floor plans.
      3) Wire runs not shown on floor plans.
      4) Wire type.
      5) Wire fill.
   j. Mounting details
      1) Provide structural mounting details and calculations with submittals and shop drawings for cabinets, terminal boards, equipment, racks (wall and floor mounted) that weigh in excess of 20 pounds.
      2) Provide general mounting details for:
         a) Racks.
         b) Speakers
   k. Installation details as required.
      1) Terminal cabinets: terminations.
   l. Wire run sheets show:
      1) Wire number.
      2) Source.
      3) Designation.
      4) Signal Type.
      5) Wire type.
      6) Operating level or voltage (if applies).

3. Shop (Fabrication) Drawings: Collate in sequence:
    a. Drawing index/symbol sheet (if separate set from field drawings).
    b. System functional (block and riser and schematic) drawings. Submit separate drawing for each system/subsystem. Show:
        1) Equipment: Function, make, model.
        2) Wire number.
        3) Wire Type.
        4) Shield condition at both ends (float, ground, location of ground.)
        5) Connector wiring details, each type.
        6) Audio: Polarity, operating level.
        7) Provide drawings for the following systems:
            a) Control.
            b) Audio.
            c) Coordinated grounding scheme.
    c. Equipment rack elevations. All racks scaled at 1", inch equals 1 foot, or larger. Show:
        1) Equipment: Function, make, model.
    d. Rack wiring drawings for, each rack:
        1) Power strip: receptacles, circuiting.
        2) Equipment.
        3) Grounding.
        4) Wiring, all systems.
        5) Wiring harness scheme.
    e. Fabrication details submit for:
        1) Receptacles.
        2) Panels.
        3) Special mounting provisions.
        4) Custom loudspeaker enclosures, indicate:
            a) Construction and bracing
            b) Tuning (include calculated curve)
        5) Legends/engraving details. Half or full size:
            a) Receptacles.
            b) Panels.
            c) Equipment.
        6) Jackfield details, front elevation, full size.
            a) Layout.
            b) Text of designations.

H. Samples: Samples for approval by the owner
1. Of all finishes/materials which will be visible to the public, including:
    a. Receptacles and controls with associated trim plate
    b. Each type of loudspeaker baffle and/or grille or cabinet with associated coordinating color samples.

I. Shop and Field Test Reports
1. Schedule: Submit test reports in timely manner relative to project schedule.
    a. Shop test report: Submit prior to shipping completed system to project site.
    b. Field test report: Submit following system completion and prior to and as condition precedent to owner's acceptance of the work of this section.
2. Test Reports: include:
    a. Time and date of test.
    b. Personnel conducting test.
    c. Test object.
    d. Procedure used.
    e. Test equipment, including serial and date of calibration.

f. Results of test - numerical or graphical presentation.

3. Verification of Submitted Test Data: Test in presence of designated observer(s) at reasonable convenience of owner. Provide technician familiar with work of this section. Provide all test equipment.

J. Reference Data for Operation, Maintenance and Repair
1. In addition to the requirements of Division 1, submit one (1) additional set. Submit in three post binders (not ring binder) with tabs.
   a. Index.
   b. Systems operating instructions.
   c. Reduced set of system record drawings.
   d. Key schedule.
   e. Maintenance and spare pans schedules.
   f. Shop and Field Test Reports.
   g. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals for each equipment item. For each set, provide manufacturer's original printed copies only. Photocopies not acceptable.

K. Record Drawings in AutoCAD R2000 format
1. Quantity:
   a. Review sets: as for Shop and Field Drawings.
   b. Record set:
      1) Three (3) bluelines.
      2) One CD with applicable .dwg files
2. Format: Record Set.
   a. Pencil, permanent ink or permanent photographic process.
   b. Vellum.
3. Content: All drawings required under “Field and Shop Drawings”. Show “as installed” condition.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be performed by workers normally engaged in this line of work, in a thorough and complete manner. Materials furnished by the contractor shall be new, and work shall be completed to satisfaction of owner.

B. Non portable equipment shall be securely held in place, including loudspeakers, shelves, cables, etc. Fastenings and supports shall be adequate to support their loads. Switches, connectors, outlets, etc., shall be clearly, logically, and permanently labeled per Section 16000.

C. Take such precautions as necessary to guard against electromagnetic and electrostatic interference, to supply adequate ventilation, and to install equipment to provide maximum safety to operating personnel.

D. Exercise care in wiring to avoid damage to cables and equipment. Joints and connections shall be made with rosin-core solder or approved mechanical connectors. Wiring shall be installed in adherence with standard broadcast practices.

E. Submit certificate of completion by equipment manufacturer's representative to assure that system has passed required tests and is in proper operating condition, and manufacturer’s

warranties and guaranties are in effect without limitations. Final tests shall be made in presence of architect who shall be notified of test date minimum of 5 days prior to date of tests.

3.2 SYSTEM VERIFICATION

A. Inspection of Sound System: Perform following inspections on sound system, and submit written results. Five days before testing, notify owner if sound system inspection will create hazardous noise conditions. Provide hearing protection for personnel during hazardous noise conditions.

B. Measure and record impedance of loudspeaker lines before connecting to amplifier. The load impedance shall be equal to or greater than rated output impedance of the amplifier.

C. Measure and record acoustic distribution of loudspeakers in sound system throughout all areas. System shall be balanced and provide uniform coverage.

D. Measure and record polarity of loudspeakers.

E. After amplifiers have been installed in rack, measure and record, with oscilloscope, output of each power amplifier on a dummy load. Input source to each amplifier being measured shall be sinewave oscillator with less than 0.5% THD. Inspect output sinewave appearing on oscilloscope for complete freedom from hum, noise, parasitic oscillation, and RF interference.
   1. All test equipment shall be calibrated
   2. Current calibration stickers shall be affixed to all test equipment for field verification
   3. All calibrated test equipment shall be calibrated by a recognized laboratory and traceable to the National Bureau of Standards.

F. Provide written test results to owner for acceptance. Field verification required.

3.3 SYSTEM GUARANTEE

A. Guarantee installation and equipment to be free from defects for one year from date of acceptance by owner.

3.4 OWNER OPERATION AND MAINTENANCE MANUALS

A. Provide 3 sets of bound operation and maintenance manuals, including submittal materials, and record of field changes. Provide complete as-built wiring diagrams in AutoCAD 2000 format. Provide disk files and original tracings A0 size in format of construction drawings.

3.5 COMMISSIONING

A. Commission systems as listed below:
   1. Prior to Functional Performance Test:
      a. System in place, including all components.
      b. Connected to emergency power system.
      c. Wiring installed in conduits and/or cable trays.
      d. System checked for grounds or breaks.
      e. Interface with telephone system.

2. Personnel present during Functional Performance Test:
   a. General Contractor, Paging System Manufacturers Representative, and Electrical Contractor.
   b. Owner's Project Manager/Representative and/or IOR.
   c. Owner's maintenance staff, as desired.
   d. Architect's Design Consultant.
3. Functional Performance Test: Contractor shall demonstrate operation of paging system per specifications including the following:
   a. Check and report any unusual line noise, low amplification at speakers.
   b. Demonstrate operation of telephone interface.
   c. Demonstrate operation of volume controls.
   d. Demonstrate operation of amplifier controls.
4. Results:
   a. If specified equipment performance is not verified, the general contractor shall see that corrections are made and reschedule functional performance test as soon as possible after corrective work is completed.
5. Reports:
   a. Submit reports of functional performance test (item "c" above) to owner.

3.6 BURN-IN

A. The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for one year from the date of final acceptance.

B. Acceptance shall consist of the following:
   1. Burn-in period.
      a. The system shall be accepted for start of warranty upon successful completion and testing.
      b. Burn-in period shall be a 30 day time frame to allow the system to operate free of defects, grounds, programming faults, etc.
      c. The 30-day burn-in shall begin the day of acceptance.
      d. The burn-in period shall be 30 days of continuous use without system trouble, false alarm, open, short or ground condition present.
      e. Should the system fail for any reason during the burn-in period, the contractor shall respond immediately upon notification.
      f. Upon correction and restoration, the burn-in period shall be re-set to "0" and the 30 day count shall begin again.
      g. Warranty shall commence upon day 31 of successful burn-in period.

3.7 WARRANTY

A. Submit written warranty with close out documentation:
   1. Provide date warranty starts and ends
   2. Provide names, address and phone numbers of service center with:
      a. Response time
      b. Lead time on major system components
      c. Disaster recovery procedure.

END OF SECTION 26 47 70

SECTION 26 49 01 GENERAL CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Pushbutton and selector switches.
2. Control stations.
3. Relays.
4. Time delay relays.
5. Control power transformers.
6. Control panels.

B. Related work:
1. Control Cabinets: Section 260130.

1.2 REFERENCES

A. NEMA ICS 1 General Standards for Industrial Control Systems.

B. NEMA ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies.

C. NEMA ICS 6 Enclosures for Industrial Controls and Systems.

D. NEMA ST 1 Standard for Specialty Transformers (Except General Purpose Type).

E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit under provisions of Section 010000.

B. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

C. Product Data: Provide for each component showing electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Contactors:
   1. Mechanically and Electrically Held Contactors: Open type, 120V coil, number of poles and ampere rating as indicated. Factory wired and installed in lighting panelboard compartment.
   2. Square D Co. Class 8903.

B. Time Switch:

1. Intermatic time switch as shown on the drawings.

C. Photo Control With Time Delay:
   1. Rated for 1000W load or 1800 VA, sp st, in weatherproof enclosure.
   2. General Electric Co. Cat. No. CR174H651, or equal.

D. Control Relays:
   1. 120 VAC coil, 10A rated contacts with number of poles indicated. Square D Co. Class 8501 Type X.
   2. 48 VDC coil, 10A rated contacts. Square D Co. Class 8501 Type KDP 12.
   3. 24 VDC coil, 10A rated contacts, plug in Type 3PDT. Square D Co. Class 8501 Type KDP 13 with NR62 socket.
   4. Pneumatic Time Delay Relay: Square D Co. Class 9050 Type B.

E. Control Units, Such as Push Buttons, Pilot Lights, Selector Switches: Heavy duty, oil tight - Square D Co. Class 9001.
   1. Push buttons, standard, full guard. Red for stop, green for start.
   2. Pilot lights, transformer type, with color caps as indicated.
   3. Selector switches, 3 position (Hand Off Automatic) manual return.
   4. Legend Plates: Standard, with legends as indicated.

2.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates with 1/4 inch minimum height letters indicating circuit designation of panel or device controlled on controls which are individually enclosed.

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION 26 49 01