3.05 FINE TUNING

A. Fine tuning will commence upon Acceptance of Work.

B. Contractor Responsibilities During Fine Tuning:

1. Correct Contract deficiencies previously outstanding and those identified during Fine Tuning.

2. Execute Change Orders issued by Owner.

3. Where Contractor startup has been properly implemented construction and design deficiencies left to be resolved during this period should be relatively minor.

   a. Ensure expedient correction of minor problems which are identified during initial occupancy.

   b. Attend regular weekly meetings with Building Manager and Building Engineer to review any operational problems.

   c. Make necessary environmental measurements and survey users to quickly identify problems and establish necessary trade inputs for resolution.

   d. Monitor and manage prompt correction of Contract deficiencies identified during initial user occupancy.

   e. Find and eliminate deficiencies in systems and equipment performance.

   f. Complete work on all fine tuning issues within first 12 months from the date of completion.

C. Commissioning Agent Responsibilities During Fine Tuning:

1. Carry out a series of systems and equipment operating tests under conditions simulating, to extent possible, full and partial operating loads.

2. Record test results.

3. Diagnose problems.

4. Repeat tests as required following correction of Contract deficiencies and execution of Change Orders by Contractor and verify results.

D. Ongoing Cycle of Fine Tuning Includes:

1. Performance testing.

2. Documentation of results.

3. Diagnosis of problems.

4. Correction of Contract deficiencies and execution of Change Orders as required.

5. Verification of results.

3.06 CONTRACT ACCEPTANCE PROCESS

A. Process for Owner's Acceptance of Work:

1. Acceptance of Work:

a. Fulfillment of prerequisites to Acceptance.

b. Inspection for Acceptance.

c. Issuance of Letter of Acceptance.

2. Completion of Fine Tuning:

a. Fulfillment of prerequisites to Completion of Fine Tuning.

b. Inspection for Completion of Fine Tuning.

c. Issuance of Letter of Completion of Fine Tuning.

3.07 PARTIAL ACCEPTANCE OF WORK: When partial utilization of Work is required and Acceptance of Work is a condition of such partial utilization, applicable requirements specified in this Section shall apply to parts of Work to be utilized.

3.08 PREREQUISITES TO ACCEPTANCE

A. Following to be completed prior to requesting Owner's inspection for Acceptance.

B. Perform Contractor Start-Up Activities.

1. Obtain and submit evidence of compliance with regulatory requirements as specified, including following:

a. Occupancy permits.

b. Inspection/operating certificates.

2. Remove from Project site temporary facilities as specified, along with construction tools, equipment, and mock-ups and similar items.

3. Complete starting of systems and equipment as specified.

4. Complete testing, adjusting and balancing of systems and equipment as specified.
5. Complete equipment and systems demonstration and instruction as specified.
6. Complete final cleaning as specified.
7. Submit Project Record Documents as specified.
8. Submit operation and maintenance data as specified.
9. Provide spare parts and maintenance materials as specified.
10. Submit product warranties and certificates of assurance as specified.
11. Make final change-over of locks and transmit keys to Owner as specified.
12. Ensure Work is ready for use for purpose intended.
13. Review Contract Documents and inspect Work to confirm that prerequisites to Acceptance of Work have been fulfilled and that Work is ready for inspection for Acceptance.

3.09 INSPECTION FOR ACCEPTANCE

A. Submit written request to Owner for inspection for Acceptance of Work, certifying prerequisites specified have been fulfilled and indicating known exceptions in list of items to be completed, corrected or submitted.

B. Owner will, within a reasonable time after receipt of Contractor's request, proceed with inspection, or advise Contractor prerequisites are not adequately fulfilled.

C. Results of Owner's inspection for Acceptance will form initial Contract deficiency list.

3.10 ACCEPTANCE OF WORK

A. Following inspection, Owner will:

1. Issue a Letter of Acceptance stating effective date of Acceptance of Work, with a copy of Contract Deficiency list attached thereto, or
2. Advise Contractor that prerequisites to Acceptance are not fulfilled and repeat inspection for Acceptance as necessary.

B. Upon issuance of Letter of Acceptance, Owner will assume responsibility for care, custody and control of Work, including responsibility for:

1. Facility operation, including all systems and equipment.

2. Maintenance.

3. Security.

4. Property insurance.

5. Utility costs.

3.11 PREREQUISITES TO COMPLETION OF START-UP FINE TUNING

A. Prerequisites to Completion of Fine Tuning Work are:

1. Prior Acceptance of Work.

2. Completion of Fine Tuning activities by Commissioning Agent and Contractor as specified.

3. Contract deficiencies identified during Fine Tuning testing and previously identified but outstanding Contract deficiencies shall have been corrected by Contractor or addressed adequately by Contractor so course of action can be established by Commissioning Agent.

4. Ensure entire work, except items arising from warranty provisions of Contract Documents, has been performed to requirements of Contract Documents.

3.12 INSPECTION FOR COMPLETION OF START-UP FINE TUNING

A. Submit written request to Owner for inspection, including copy of Owner's most recent Contract Deficiency list, certifying each Contract deficiency has been corrected or otherwise resolved in a manner agreed to between Owner and Contractor.

1. List known exceptions, if any, in request.

B. Owner will within a reasonable time after receipt of Contractor's request:

1. Proceed with inspections, or

2. Advise Contractor prerequisites are not adequately fulfilled.

C. Following inspection, Owner will:

1. Issue a Letter, stating effective date of completion of start-up Fine Tuning.

2. Advise Contractor of Contract deficiencies to be corrected prior to issuance of Letter completion of start-up Fine Tuning.

3.13 SUBMITTALS

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires in facilitating the commissioning work. These requirements will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation detailed startup procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of Owner contracted tests. In addition, the installation checkout materials that are actually shipped inside the equipment and the actual field checkout street forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. All documentation required by the CA will be included by the Subs in their O&M contributions.

B. The Commissioning Authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the function performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning Authority will notify the CM, PM, or A/E as requested of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.14 PHASED COMMISSIONING (IF APPLICABLE)

A. The project may require startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, CM, GC and the Mechanical, TAB, Controls Contractors. Results will be added to the master and commissioning schedule.

3.15 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The CA shall witness and document the results of functional performance tests using the specific procedural forms. Prior to testing, these forms are provided to the CM for review and approval and to the Subs for review.

B. Non-Conformance:

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the CM on a

standard non-compliance form.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA is not obligated to overlook deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the CM.

4. As test progress and a deficiency are identified, the CA discusses the issue with the executing contractor.

    a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

        1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy give to the CM and to the Sub representative assumed to be responsible.

        2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.

    b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

        1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the CM and to the Sub representative assumed to be responsible.

        2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/e. Final acceptance authority is with the Project Manager.

        3) The CA documents the resolution process.

        4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. Cost of Retesting:

   a. The cost for the Sub to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

   b. For a deficiency identified, not related to any pre-functional checklist or startup fault, the following shall apply. The CA and CM will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CA's and CM's time for a second retest will be charged to the GC, who may choose to recover the costs from the responsible Sub.

   c. The time for the CA and CM to direct any retesting required because a specific *pre-functional* checklist or startup test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the GC, who may choose to recover costs from the part responsible for executing the faulty pre-functional test.

   d. Refer to the sampling section of Part 3.06 of this Section for requirements for testing and retesting identical equipment.

6. The Contractor shall response in writing to the CA and CM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

7. The CA retains the original non-conformance forms until the end of the project.

8. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

3.16 OPERATION AND MAINTENANCE MANUALS

A. Submission by Contractor(s):

   1. Submit three typed and bound copies of Operating and Maintenance (O&M) Manuals prior to scheduling systems demonstrations for the Owner's Representative.

   2. Bind each Maintenance Manual in one or more vinyl covered, 3-ring binders, with pockets for folded drawings.

      a. Mark the spine of each binder with system identification and volume number.

B. Required Contents:

1. Manuals shall have index with tab dividers for each major equipment section to facilitate locating information on a specific piece of equipment.

2. Identify data within each section with drawing code numbers as they appear on Drawings. Include as a minimum the following data:

   a. Alphabetical list of system components, with the name, address and 24 hour telephone number of the company responsible for servicing each item during the first year of operation. Include point of contact for company.

   b. Operating instructions for complete system including:

      1) Emergency procedures for fire and failure of major equipment.

      2) Major start, operation and shut down procedures.

   c. Maintenance Instructions for Each Piece of Equipment Including:

      1) Equipment lists.

      2) Proper lubricants and lubricating instructions for each piece of equipment.

      3) Necessary cleaning, replacement and/or adjustment schedule.

      4) Product data.

      5) Installation instructions.

      6) Parts list.

      7) Temperature control diagrams and O&M information as specified above.

   d. Marked or changed prints locating concealed parts and variations from the original system design (as-built drawings).

   e. Balancing report.

   f. Valve schedule and associated piping schematics.

   g. Copies of any extended equipment warranties which are greater than one year.

C. A/E Contribution: The A/E will include in the beginning of the O&M manuals a separate section containing an updated design intent narrative to reflect as-built status.

D. CA Review: Prior to substantial completion, the CA shall review the O&M manuals, documentation and redline as-builts for *systems that were commissioned.* The CA will communicate deficiencies in the manuals to the CM, PM or A/E, as requested. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

E. Commissioning Record in O&M Manuals:

1. The CA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it the GC, to be included with the O&M manuals. Three copies of the manuals will be provided. The format of the manuals shall be:

   a. Tab 1-1: Commissioning Plan.

   b. Tab 1-2: Final Commissioning Report (see E.2 below).

   c. Tab 01: System Type 1 (packaged unit, exhaust fans, boiler system, etc.)

      1) Sub-Tab A; Submittals of approved equipment.

      2) Sub Tab B: Startup plan and report, manufacturer's installation instructions, blank pre-functional checklists.

      3) Sub Tab C: Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended re-commissioning schedule.

      4) Use Separator Sheets – for each equipment type (fans, pumps, chiller, etc.)

   d. Tab 02: System Type 2 – repeat as per System Type 1.

   e. Tab 03 to Tab XX: Continue for all System Type – repeat as per System Type 1.

2. Final Report Details: The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All outstanding non-compliance items shall be specifically listed. Future actions,

commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS tend logs, data loggers, etc.) and include observations and conclusions from the testing.

3. The CA will retain other documentation.

3.17 WARRANTIES

A. The warranty period is one year after Date of Acceptance.

1. During this period, provide labor and materials as required to repair or replace defects in the mechanical system at no additional cost to the Owner. Provide certificate with O&M Manual submittal, which guarantees same-day service response to Owners call for all such warranty service.

2. Provide certificate for such items of equipment, which have warranties in excess of one year. Insert copies in O&M Manuals.

3. Provide extended manufacturers warranties to cover one full year from date of acceptance if standard warranty starts any time prior to that date.

4. Provide factory trained service personnel for all warranty work on the Building Automation and Automatic Temperature Control System.

3.18 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CA shall be responsible for overseeing the content and adequacy of the training of Owner personnel for commissioned equipment.

1. The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and vendors who have training responsibilities.

2. For the primary HVAC equipment, the Controls Contractor shall provide a discussion of the control of the equipment during the mechanical or electrical training conducted by others.

3. The CA develops an overall training plan and coordinates and schedules, with the CM and GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily

completed, including attending some of the training, etc.

4. The Owner may provide videotaping of the training sessions and the tapes added to the O&M manuals.

5. The mechanical design engineer shall at the first training session present the overall system design concept.

3.19 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

END OF SECTION

SECTION 01811

MECHANICAL SYSTEM COMMISSIONING

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the startup, operating performance test and commissioning of the building mechanical systems described herein.

B. The Mechanical Contractor and the General Contractor shall include as part of the work of this contract, labor and material to provide manpower, equipment, tools, ladders, instruments, etc. necessary to accomplish the work and labor and material for execution, monitoring and printing data forms necessary to verify and record system observations.

C. The Test and Balance Contractors shall include as part of the work of this contract, labor and material to provide manpower, equipment, tools, ladders, instruments, etc. necessary to execute and accomplish the work.

D. At the completion of the startup, operations performance test and test and balance, the Contractor shall conduct a 72 hour dynamic mode demonstration of the systems in the presence of the Owner/Architect/Engineer and CA.

E. The list of equipment and/or systems to be commissioned for the building under the base bid is as follows:

1. Exhaust Fans EF-1 thru EF-9.
2. Rooftop Packaged Unit AC-1 thru AC-6.
3. Split System Indoor Cooling Only Units FC-1 and FC-2.
4. Split System Outdoor Condensing Unit CU-1 and CU-2.
5. Gas-Fired Water Heater WH-1.
6. Domestic Hot Water Circulating Pump CP-1.

1.02 RELATED WORK

A. The requirements of the General Conditions, Supplemental Conditions, Section 01810 apply to all work specified in this section.

1.03 RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors: The commissioning responsibilities applicable to each of the mechanical, controls, and TAB contractors are as follows (all references apply to commissioned equipment only):

1. Construction and Acceptance Phases:

   a. Include and itemize the cost of commissioning in the contract price.

   b. In each purposed order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.

   c. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Commissioning process.

   d. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.

   e. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.

      1) Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures full details of any owner-contracted tests, fan and pump curves, full factory testing reports, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.

      2) The Commissioning Agent may request further documentation necessary for the commissioning process.

      3) This data request may be made prior to normal submittals.

   f. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.

   g. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

   h. Provide limited assistance to the CA in preparing the specific functional performance test procedures as specified herein. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

i. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists form the CA for all commissioned equipment. Submit to CA for review and approval prior to start-up. Refer to Section 01810 for further details on start-up plan preparation.

j. During the start-up and initial checkout process, execute the mechanical related portions of the prefunctional checklists for all commissioned equipment.

k. Perform and clearly document all completed start-up and system operational checkout procedures, providing a copy to the CA.

l. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air or water related systems.

m. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary test, adjustments and problem solving.

n. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment herein and in Section 01810. Assist the CA in interpreting the monitoring data, as necessary.

o. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, CM and A/E and retest the equipment.

p. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences to as-built conditions.

q. During construction, maintain as-built reline drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).

r. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

s. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Warranty Period:

a. Execute seasonal or deferred functional performance testing.

b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified during testing.

B. Mechanical Contractor: The commissioning responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. Provide startup for all HVAC equipment, except for the building automation control system.

2. Assist and cooperate with the TAB contractor and CA by:

a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.

b. Including cost of sheaves and belts that may be required by TAB.

c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

d. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

3. Install a P/T plug at each water sensor that is an input point to the control system.

4. List and clearly identify on the as-built drawings the locations of all airflow stations.

5. Prepare a preliminary schedule for pipe and duct system testing flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

6. Notify the CM and CA, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the CM and CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

C. Controls Contractor: The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. Sequences of Operation Submittals: The Control Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the Specifications. They shall include:

a. An overview narrative of the system of the system (1 or 2 paragraphs) generally describing its purpose, components and function.

b. All interactions and interlocks with other systems.

c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.

d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).

e. Start-up sequences.

f. Warm-up mode sequences.

g. Normal operating mode sequences.

h. Unoccupied mode sequences.

i. Shutdown sequences.

j. Capacity control sequences and equipment staging.

k. Temperature and pressure control: Setbacks, setups, resets, etc.

l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.

m. Effects of power or equipment failure with all standby component functions.

n. Sequences for all alarms and emergency shut downs.

o. Seasonal operational differences and recommendations.

p. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

q. Schedules.

r. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

2. Control Drawings Submittal:

   a. The control drawings shall have a key to all abbreviations.

   b. The control drawings shall contain graphic schematic depictions of the systems and each component.

   c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

   d. Provide a full points list with at least the following included for each point:

      1) Controlled system.
      2) Point abbreviation.
      3) Point description.
      4) Display unit.
      5) Control point or setpoint (Yes/No).
      6) Monitoring point (Yes/No).
      7) Intermediate point (Yes/No).
      8) Calculated point (Yes/No).
      9) Key:
         a) Point description: DB temp, airflow, etc.
         b) Control or setpoint: Point that controls equipment and its setpoint changed (OSA, SAT, etc.)
         c) Intermediate point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).
         d) Monitoring point: point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
         e) Calculated point: "Virtual" point generated from calculations of other point values.
         f) The Controls Contractor shall keep the Ca informed of all changes to this list during programming and setup.

3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

4. Assist and cooperate with the TAB contractor in the following manner:

   a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).

b. For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.

c. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

5. Assist and cooperate with the CA in the following manner:

a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system as specified for the controls contractor herein and Section 01812. Assist in the functional testing of all equipment specified herein and Section 01812. Provide two-way radios during the testing.

b. Execute all control system trend logs specified herein and Section 01812.

6. Provide a signed and dated certification to the CA and CM upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements. Provide completed field checkout forms to the CA.

7. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

D. TAB Contractor: The duties of the TAB Contractor, in addition to those listed in (A) are:

1. Six weeks prior to starting TAB, submit to the CM the qualification of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician on which was lead. The Owner will approve the site technician's qualifications for this project.

2. Submit the outline of the TAB plan and approach for each system and component to the CA, CM and the Controls Contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.

3. The submitted plan will include:

a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.

b. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.

c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

e. Final test report forms to be used.

f. Detailed step-by-step procedures for TAB work for each system and issue: Terminal flow calibration (for each terminal type), diffuser proportioning, branch/submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.

g. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters and formulas to be used.

h. Details of how total flow will be determined (Air: Sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply air (SA) and return air (RA) traverse, SA or RA flow stations. Water: Pump curves, circuit setter, flow station, ultrasonic, etc.).

i. The identification and types of measurement instruments to be used and their most recent calibration date.

j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.

k. Confirmation that TAB understands the outside air ventilation criteria under all conditions.

l. Details of whether and how minimum outside air cfm will be verified and set, for what level (total building, zone, etc.).

m. Details of how building static and exhaust fan/relief damper capacity will be checked.

n. Proposed selection points for sound measurements and sound measurement methods.

o. Details of methods for making any specified coil or other system plant capacity measurements.

p. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.

q. Details regarding specified deferred or seasonal TAB work.

r. Details of any specified false loading of systems to complete TAB work.

s. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.

t. Details of any required interstitial cavity differential pressure measurements and calculations.

u. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

v. Plan for formal progress reports (scope and frequency).

w. Plan for formal deficiency reports (scope, frequency and distribution).

4. The tab field technicians shall keep a running log of events and issues. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and CM at least twice a week.

5. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect the control system setup and operation.

6. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC.

7. Provide the CA with any requested data, gathered, but not shown on the draft reports.

8. Provide a final TAB report for the CA with details, as in the draft.

9. Conduct functional performance tests and checks on the original TAB as specified for TAB herein.

E. Mechanical Designer: Refer to Section 01810 for the responsibilities of the mechanical designer.

1.04 COMMISSIONED SYSTEMS (List Systems)

A. All mechanical equipment scheduled on sheets labeled "M" and "P" are to be included as part of the commissioning effort.

1.05 RELATED WORK

A. Refer to Section 01810, Part 1 for a listing of sections where commissioning requirements are found.

PART 2 – PRODUCTS

2.01 MATERIALS, LABOR, INSTRUMENTS, TOOLS, LADDERS AND APPARATUS

A. The Contractor shall provide all materials, labor, instruments, tools, ladders and apparatus necessary to startup, perform operating performance test and systems conditioning.

B. The Contractor shall be responsible for maintaining the commissioning documentation until final acceptance of the project. The checklists in appendix one are samples for bidding purposes. Final checklists will be produced by the CA and provided prior to beginning commissioning. The commissioning documentation shall be kept current by the Contractor and shall be available for inspection at all times. At the time of acceptance of the project, the Contractor shall surrender 3 complete copies of the commissioning documentation to the Owner's representative.

2.02 TEST EQUIPMENT

A. Mechanical Contractor shall provide test equipment necessary to fulfill the testing requirements of this Division.

PART 3 – EXECUTION

3.01 SUBMITTALS

A. Submittal documentation relative to commissioning as required in this Section, Part 1, and Section 01810.

3.02 STARTUP

A. The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in Section 01810. Mechanical Contractor has start-up responsibility and is required to complete systems and subsystems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not

relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or subsystems at the discretion of the CA and CM. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.03 TAB

A. Refer to the TAB responsibilities in Part 1 above.

3.04 FUNCTIONAL PERFORMANCE TESTS

A. Refer to Section 01810, Part 1 for a list of systems to be commissioned and to Part 3 for a description of the process and herein for specific details on the required functional performance tests.

3.05 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. Refer to Section 01810, Part 3 for specific details on non-conformance issues relating to prefunctional checklists and tests.

B. Refer to Section 01810, Part 3 for issues relating to prefunctional tests and startup.

3.06 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in the Specifications.

B. Mechanical Contractor shall compile and prepare documentation for equipment and systems and deliver his documentation to the GC for inclusion in the O&M manuals, according to this section and Section 01810, prior to the training of Owner personnel.

C. The CA shall receive a copy of the O&M manuals for review.

D. Special TAB Documentation Requirements: The TAB will compile and submit the following with other documentation that may be specified elsewhere in the Specifications.

E. Final report containing and explanation of this methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon, abbreviations and column headings.

F. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.

G. Reviews: Review of the commissioning related sections of the O&M manuals will be conducted by the A/E and by the CA. Refer to Section 01810, Part 3 for details.

3.07 TRAINING OF OWNER PERSONNEL

A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01810 for additional details.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment or systems. Refer to Section 01810 for additional details.

C. Mechanical Contractor: The mechanical contractor shall have the following training responsibilities:

1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01810, Part 3.

2. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure etc.

3. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of each modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.

4. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate wherever possible the use of the O&M manuals for reference.

5. Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for the pieces of equipment.

6. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

7. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

8. Duration of Training: The mechanical contractor shall provide training on each piece of equipment, with a minimum time of (1) one hours for each piece of equipment.

D. Controls Contractor: The controls contractor shall have the following training responsibilities:

1. Provide the CA with a training plan four weeks before the planned training according to the outline described in Section 01810, Part 3.

2. The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.

3. The trainers will be knowledgeable on the system and its use in the buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.

4. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

5. There shall be at least one training session on the Building Systems. The session shall be held on-site for a period of four (4) hours of actual hands-on training after the completion of system commissioning. The session shall include instruction on:

   a. Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

   b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set-points and alarms and other typical changed parameters, overrides, manual operation of equipment, optional control strategies that can be considered, energy saving strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

   c. All trending and monitoring features (values, change of state, totalization, etc.) including setting up, executing, downloading, viewing both tabular and graphically printing trends. Trainees will actually set-up trends in the presence of the trainer.

   d. Every screen shall be completely discussed, allowing time for questions.

   e. Use of keypad or plug-in laptop computer at the zone level.

   f. Use of remote access to the system via phone lines or networks.

   g. Setting up and changing an air terminal unit controller.

h. Graphics generation.

i. Point database entry and modifications.

j. Understanding DDC field panel operating programming (when applicable).

E. TAB: The TAB contractor shall have the following training responsibilities:

1. TAB shall meet for two (2) hours with facility staff after completion of TAB and instruct them on the following:

a. Go over the final TAB report, explaining the layout and meanings of each data type.

b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.

c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

e. Other salient information that may be useful for facility operations, relative to TAB.

3.08 DEFERRED TESTING

A. Refer to Section 01810, Part 3 for requirements of deferred testing.

3.09 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described in Section 01810 and the filled out start-up, initial checkout and prefunctional checklists.

PART 4 – PRE-FUNCTIONAL AND FUNCTIONAL CHECKLISTS

4.01 PRE-FUNCTIONAL TEST DESCRIPTION

A. This section contains representative Pre-functional checklists (PC) in a form format. Actual Pre-functional Checklists will be provided at a later date.

1. The checklists contain items for both Mechanical and Electrical contractors to perform. On each checklist, a column is provided that should be filled out by the contractor assigning responsibility for that item to a trade.

2. Those executing the checklists are only responsible to perform items that apply to the specific application at hand. These checklists do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant of some checkout procedures that will be documented on typical factory field checkout sheets. Double documenting is required in those cases.

3. Refer to Section 01810 for additional requirements regarding pre-functional checklists, startup and initial checkout. Items that do not apply should be noted along with the reasons on the form. Any forms used for documenting the PCs will be in addition to the PC forms provided by the CA. Contractors assigned responsibility for sections of the checklist shall be responsible to see that the checklist items by their subcontractors are completed and checked off. "Contr." column or abbreviation in brackets to the right of an item refers to the contractor

   responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

4.02 PREFUNCTIONAL AND FUNCTIONAL CHECKLISTS

A. Sample checklist forms follows:

Prefunctional Checklist – Exhaust Fans ID

Project _____

1. Submittal / Approvals:

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This prefunctional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Prefunctional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor, ____ = _____.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

2. Requested Documentation Submitted:

Check if Okay. Enter comment or note number if deficient.

Check / Equip Tag->						Contr.
Manufacturer's cut sheets						
Performance data (fan curves, coil data, etc.)						
Installation and startup manual and plan						
Sequences and control strategies						
O&M manuals						

- ***Documentation complete as per contract documents for given trade ___ YES ___ NO***

3. Model Verification:

1 = as specified, 2 = as submitted, 3 = as installed.

Check if Okay. Enter note number if deficient.

Equip Tag--->						
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
CFM	1					
	2					
	3					
Sound Pwr						
Level @ 63,						
250; 1K Hz						

- ***The equipment installed matches the specifications for given trade ___ YES ___ NO***

4. Installation Checks:

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->						Contr.
Cabinet and General Installation							
Permanent labels affixed							
Casing condition good: no dents, leaks, door gaskets installed							
Mountings checked and shipping bolts removed							
Vibration isolators installed							
Equipment guards installed							
Pulleys aligned							
Belt tension correct							
Plenums clear of debri							
Fans rotate freely							
Fire and balance dampers installed							
Backdraft dampers installed, per drawings, and operate freely							
Duct system complete							
Electrical							
Electrical connections complete							
Disconnect switch installed							
Overload heaters in place							
Control connections complete							
Operational Checks							
Fan rotation correct							
Electrical interlocks verified							
Any fan status indicators functioning							
No unusual vibration or and noise							
Record full load running amps for each fan. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?							
Check voltage: Rate = _____ Actual = _____ Within 5%?							
The disconnect switch properly operates							
After 24 hours of operation, recheck belt tension and alignment							

- ***The checklist items of Part 4 are all successfully completed for given trade ___YES ___NO***

-- END OF CHECKLIST—

END OF SECTION

SECTION 01812

ELECTRICAL EQUIPMENT COMMISSIONING

PART 1 - GENERAL

1.01 RELATED WORK

A. Drawings and general provisions of the contract shall apply to work in this section.

B. 01810 Building Commissioning.

C. 01811 Mechanical System Commissioning.

1.02 SUMMARY OF WORK

A. The Electrical Commissioning shall include the Testing and Certification of; the general electrical equipment installation, and the installed Lighting System Design and associated controls.

1.03 WORK NOT INCLUDED

A. The following systems are not included in the Electrical Commissioning work:

1. Fire Alarm System
2. Public Address/Background Music System
3. Telephone System
4. Computer Network System
5. Security System
6. CCTV System

B. The entity responsible for certifying these systems is shown in parenthesis. While the commissioning of these systems is not included in this work scope, these systems (particularly Fire Alarm and Telephone) will need to be installed and operational to complete certain portions of this work where interfaces with these systems is required to verify the system operational requirements of the Lighting System.

1.04 SUBMITTALS

A. Provide submittal documentation relative to commissioning as described in Section 01810.

PART 2 – PRODUCTS

2.01 TEST EQUIPMENT

A. Refer to Section 01810 PART 2.

PART 3 – EXECUTION

3.01 COMMISSIONING PROCESS REQUIREMENTS

A. Refer to Section 01810 and related sections for information on meetings, start-up plans, functional testing, operations & maintenance data, training requirements, and other Commissioning activities.

3.02 TESTING REQUIREMENTS

A. The commissioning authority will prepare testing procedures using the Design Intent Document, the testing requirements listed in these specifications, and commissioning data submitted by the contractors in accordance with these specifications. The testing procedures will require the following minimum information:

1. Test number.
2. Date and time of the test.
3. Indication of whether the record is for a first test or retest following correction of a problem or issue.
4. Identification of the system, subsystem, assembly, or equipment.
5. Conditions, under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.
6. Expected performance of the systems and assemblies at each step of the test.
7. Narrative description of observed performance of the system, equipment, or assembly.
8. Notation to indicate whether the observed performance at each step meets the expected results.
9. Issue number, if any, generated as the result of the test.

10. Dated signatures of the person performing the test and of the witness.

B. General Electrical Equipment Installation: The following electrical equipment and systems shall be tested and calibrated:

1. Conductors.
2. Wiring Devices.
3. Panel boards.
4. Transformers.
5. Low Voltage Front Accessible Main Switchboard.
6. Motor Control.
7. Underground Electrical Site Distribution.
8. Grounding System.

C. Lighting System and Controls Testing Requirements. This is a performance test to verify lighting system operation, light levels, and energy usage.

1. Electrical subcontractor to start-up and to document lighting system and controls under the observation of the CA using a start-up plan prepared by the contractor. Start-up Plans are described in Section 01810.
2. Electrical subcontractor to perform functional testing under the observation of the commissioning authority who will record the results of the functional test procedures.
3. Equipment & Components to be tested: Lighting System and Controls.
4. Functions, modes, and Testing Conditions

    a. Occupancy sensors and timer controls for lighting

        1) Verify that all specified functions and features are set up, debugged and fully operable.

        2) Verify that occupant over-rides features function

        3) Verify that sensor durations are set properly

        4) Test the sequence of operation for all features and modes and confirm that adjustable timing matches the design specifications

b. Electric lighting dimming photocells and controls

c. Illumination Levels, Night Conditions:

1) Verify that lighting throughout the building is operating automatically

2) Test with doors closed (to simulate actual occupancy), after finishes are complete, and room is furnished.

3) Verify that a minimum of one (1) foot-candle is maintained along the path of egress from the building to the property line upon loss of primary power.

d. Illumination Levels, Day Conditions:

1) Verify that lighting throughout the building is operating automatically

2) Test with doors closed (to simulate actual occupancy), after finishes are complete, and room is furnished.

3) Verify that exterior site lighting automatically turns off one half after sunrise and turns on one half hour before sunset.

4) Verify that one foot-candle is maintained along the path of egress at the interior of the building.

e. Lighting Power Density. Perform the test with all interior lighting turned on and any manual or automatic controls temporarily overridden. The lighting power shall be measured at the building's electrical panels. Measurements shall be taken at least 1 minute after all lighting in the building is on.

5. LEED's Lighting Requirements:

a. Test all exterior lighting fixtures to verify compliance with LEEDs light pollution requirements. (No up lighting component requirement.)

b. Test all exterior lighting fixtures to verify fixtures do not spill direct light rays onto adjacent properties. (Light cut-off requirement.)

6. Acceptance Criteria

a. Lighting Controls: For the conditions, sequences and modes tested, the occupancy/photocell/timing controls, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

b. Illumination Levels: Average light levels in the tested space at the workplane elevation shall not be less than 30% below nor greater than 30% above the specified light level range for the space.

c. Lighting Power Density: Average instantaneous lighting power density is +/- 15% of the design lighting power density. Power factors on lighting circuits are at least 0.95, or as required by lighting fixture specifications.

7. Sampling Strategy for Identical Units:

a. Lighting Controls: Test all automatic interior lighting controls

b. Illumination Levels: At least 50% of all space zones and rooms shall be verified to be realizing proper light levels, chosen by the Owner. If 25% of the spaces in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the spaces in the 2nd sample fail, test all remaining spaces, fully at the contractor's expense.

c. Power Density: No sampling. Test all lighting circuits.

PART 4 – PRE-FUNCTIONAL AND FUNCTIONAL CHECKLISTS

4.01 PRE-FUNCTIONAL TEST DESCRIPTION

A. This section contains representative Pre-functional checklists (PC) in a form format. Actual Pre-functional Checklists will be provided at a later date.

1. The checklists contain items for both Mechanical and Electrical contractors to perform. On each checklist, a column is provided that should be filled out by the contractor assigning responsibility for that item to a trade.

2. Those executing the checklists are only responsible to perform items that apply to the specific application at hand. These checklists do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant of some checkout procedures that will be documented on typical factory field checkout sheets. Double documenting is required in those cases.

3. Refer to Section 01810 for additional requirements regarding pre-functional checklists, startup and initial checkout. Items that do not apply should be noted along with the reasons on the form. Any forms used for documenting the PCs will be in addition to the PC forms provided by the CA. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that the checklist items by their subcontractors are completed and checked off. "Contr." column or abbreviation in brackets to the right of an item refers to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all

contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

4.02 PREFUNCTIONAL AND FUNCTIONAL CHECKLISTS

A. Sample checklist forms follow:

Prefunctional Checklist - Lighting System

Project: _____

Lighting System (and Controls), ____ Entire Bldg, ____ Floor #

1. Submittals / Approvals:

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This pre-functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Electrical Contractor	Date	General Contractor	Date

Pre-functional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

2. Installation Checks:

Check if Okay. Enter N/A if not applicable. Enter Note number if deficient (attach notes).

Complete table for each room.

Check	Rooms →					Contr.
Lighting fixtures and switches						
Light switches are located per plans						
Light switches are labeled with proper ID to match drawings or field changes						
Light switch is controlling the fixtures in the area indicated on design drawings						
Fixtures are properly supported for seismic zone						
Verify proper lamp type is installed in each fixture to match fixture schedule and specifications						
Lighting controls						
Lighting control is installed per manufacturer recommendations (attached recommendations to this checklist)						
Lighting control is calibrated per manufacturer checklist						

Check if Okay. Enter N/A if not applicable. Enter Note number if deficient (attach notes).

Complete table for each room.

Check	Rooms →					Contr.
Lighting fixtures and switches						
Light switches are located per plans						
Light switches are labeled with proper ID to match drawings or field changes						
Light switch is controlling the fixtures in the area indicated on design drawings						
Fixtures are properly supported for seismic zone						
Verify proper lamp type is installed in each fixture to match fixture schedule and specifications						
Lighting controls						
Lighting control is installed per manufacturer recommendations (attached recommendations to this checklist)						
Lighting control is calibrated per manufacturer checklist						

Check if Okay. Enter N/A if not applicable. Enter Note number if deficient (attach notes).

Complete table for each room.

Check	Rooms →					Contr.
Lighting fixtures and switches						
Light switches are located per plans						
Light switches are labeled with proper ID to match drawings or field changes						

Complete table for each room.

Check Rooms →					Contr.
Light switch is controlling the fixtures in the area indicated on design drawings					
Fixtures are properly supported for seismic zone					
Verify proper lamp type is installed in each fixture to match fixture schedule and specifications					
Lighting controls					
Lighting control is installed per manufacturer recommendations (attached recommendations to this checklist)					
Lighting control is calibrated per manufacturer checklist					

Check if Okay. Enter N/A if not applicable. Enter Note number if deficient (attach notes).

Complete table for each room.

Check Rooms →					Contr.
Lighting fixtures and switches					
Light switches are located per plans					
Light switches are labeled with proper ID to match drawings or field changes					
Light switch is controlling the fixtures in the area indicated on design drawings					
Fixtures are properly supported for seismic zone					
Verify proper lamp type is installed in each fixture to match fixture schedule and specifications					
Lighting controls					
Lighting control is installed per manufacturer recommendations (attached recommendations to this checklist)					
Lighting control is calibrated per manufacturer checklist					

Checklist items of Part 2 are all successfully completed for given trade ____**Yes** ____**No**

-- END OF CHECKLIST --

END OF SECTION

DIVISION 2
SITEWORK

SECTION 02110

SITE CLEARING

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all site clearing, tree protection, and demolition as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

B. Related work specified elsewhere:

1. Removal or abandonment of mechanical or electrical underground piping or conduit, except storm sewers: Divisions 15 and 16.

1.02 QUALITY ASSURANCE

A. Perform work in accord with OSHA and EPA requirements and state and local requirements.
B. Comply with Rancho Mirage and SCAQMD PM10 Regulations.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROTECTION

A. Provide barricades, coverings, and other protection necessary to prevent damage to existing improvements to remain.

1. Protect improvements on adjoining properties as well as those on Owner's property.

2. Restore any improvements damaged by this work to original condition, as acceptable to Owner or other parties or authorities having jurisdiction.

B. Protect existing trees and other vegetation to remain against damage.

1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.

2. Avoid foot or vehicular traffic or parking of vehicles within drip line.

3. Provide temporary protection as required.

3.02 SITE CLEARING - GENERAL

A. Owner shall remove all trees and/ or shrubs the Owner desires to have salvaged and transplanted. The Owner shall be responsible for this work as designated on the Landscape Demolition Plan. All other trees and shrubs shall be removed by the Contractor including stumps and roots.

B. Remove other items when specifically indicated.

C. Follow regulations and directives per PM10 drawings.

3.03 REMOVAL OF IMPROVEMENTS

A. Remove surfacing and pavements, including bases, concrete slabs, concrete curb and gutter, valve boxes, concrete and masonry walls, posts, poles and other items indicated.

B. Remove foundations, footings, walls and other items indicated.

C. Remove underground storm drainage piping which interferes with construction.

3.04 DISPOSAL OF WASTE MATERIALS

A. Do not burn combustible materials on site.

B. Remove all waste materials from site.

C. Do not bury organic matter on site.

D. Remove all rock, concrete and masonry from site.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for earthwork, excavating, and backfilling as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. Permits and Ordinances:

1. Produce and pay for all necessary permits or certificates required by local authorities having jurisdiction over the work.

C. All excavation is unclassified.

D. Related work specified elsewhere:

1. Section 02260 - Finish Grading

2. Section 02513 – Asphaltic Concrete Paving

3. Section 02520 – Concrete Paving and Curbs

4. Section 02632 – Trench Grates and Frames

5. Section 02720 – Strom Drainage System

E. Definitions:

1. Unclassified excavation: Excavate and grade all materials that can be removed without blasting or drilling.

2. Engineer: Soils Engineer employed by Owner, empowered to conduct inspections and make approvals.

3. Soils Report: Report No. LP06084 prepared by Landmark dated April, 27 2006 and located in Section 00220 – Geotechnical Data.

1.02 QUALITY ASSURANCE

A. Perform work in accord with CAL-OSHA requirements and State and Local requirements.

B. Compaction density test: Modified Proctor ASTM D1557-78.

1. Layout work shall be performed by a licensed surveyor or civil engineer registered in State of California.

2. Maintain all bench marks, control monuments or stakes, whether newly established by Surveyor or previously existing. Protect from damage and discoloration. If necessary to disturb existing bench marks, re-establish in a safe place.

3. If any discrepancies are found by Surveyor between the Drawings and actual conditions at the Site, Architect reserves the right to make such minor adjustments in work specified as necessary to accomplish the intent of the Contract Documents, without increased cost to the Owner.

C. Owner will hire and pay for an independent geotechnical laboratory to conduct in-place moisture and density tests.

1. Geotechnical Engineer:

a. Landmark Geotechnical Engineers and Geologists – (760) 360-0665 (See Section 01400 – General Testing Procedures.)

2. Initial tests shall be paid by the Owner. If initial test fails, further re-testing shall be paid by the Contractor.

3. Soil Testing Laboratory shall provide copies of soil compaction testing to Architect, Contractor, Owner, and City of Palm Springs.

4. A satisfactory number of compaction tests shall be conducted in all foundation areas to insure the compaction requirements covered in paragraphs 3.02 of this section.

D. Tolerances of sub-grade:

1. Unsurfaced areas: 0.20 Ft. plus/minus from required elevations.

2. Paved areas: 0.10 Ft. plus/minus from required elevations.

1.03 JOB CONDITIONS

A. Protect existing facilities, utilities, (overhead and underground), sidewalks, and pavement.

1. Repair damaged items. Notify the Architect immediately of any unforeseen utilities and make emergency repairs as necessary.

2. Where existing utilities not shown on the Drawings are encountered, support, shore-up, protect same and immediately notify Architect. Allow entrance, opportunity and ample time for measures necessary for continuance and/or relocation of such services. Cost of repair to items not indicated on plans shall be paid for by the Owner.

3. Where noted on Drawings, cut and cap all street connections encountered in excavating along curb line and mark location so they can subsequently be located and reconnected as required.

B. Protect graded areas against erosion.

1. Keep all excavations, pits, trenches, footings, etc., entirely free from water.

2. Re-establish grade where settlement or washing occurs at no extra cost.

C. The Contractor shall be responsible for providing an effective means of PM10 dust control, which shall include provisions or adequate watering during the grading process and provisions for continuance of dust control after the grading, until such time that the graded surface presents efficient protective cover against wind or water erosion, and that special dust control measures are no longer necessary.

1.04 SUBMITTALS (SEE SECTION 01340)

A. Pad Certification by licensed Surveyor. Submit Certification letter to Architect, Contractor , and City of Palm Desert.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fill and backfill materials:

1. Clean soil similar to on-site soil or non-expansive soil, granular soil meeting the USCS classifications of SM, SP-SM, or SW-SM and free of roots, organic material, trash, and stones larger than 3". The geotechnical engineer shall approve all imported fill soil sources before hauling material to the site. Imported granular fill shall be placed in lifts of

no greater than 8 inches in loose thickness and compacted to a minimum of 90% of ASTM D1557 maximum dry density at least 2% above optimum moisture.

2. Add water to dry material, as required.

3. Allow wet material to dry, as required.

4. Provide additional borrow or fill as required, at no extra cost.

   a. Provide non-expansive material with plasticity Index less than 35, maximum 1" particle size, and approved by Soils Engineer.

5. No borrow or fill can be obtained on site, except as removed from excavating and grading, and only non-expansive type soils.

B. Surplus material:

1. Remove hard debris, such as concrete and stone, from site.

2. Clean fill material of the non-expansive type may be disposed of on-site in location designated by Soils Engineer.

3. Remove from the site and legally dispose of all debris and excavated material not required for fill. No rubbish or debris shall be buried on the site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Layout structures, water features, parking area, walks and establish their elevations.

B. Perform all other layout work required.

C. Replace property or building corner markers to original location if disturbed or destroyed.

D. All areas to be graded should be stripped of significant vegetation, and other deleterious materials. Root balls shall be completely excavated and removed from the site. Organic strippings shall be hauled from the site and not used as fill. Any trash, construction debris, concrete slabs, old pavement, landfill, and buried obstructions such as old foundations and utility lines exposed during excavation should be traced to the limits of the foreign material by the grading contractor and removed under the supervision of the geotechnical engineer. Any excavations resulting from site clearing shall be dish-shaped to the lowest depth of disturbance and backfilled under the observation of the geotechnical engineer.

E. The cavities created by the removal of vegetation, exploratory trenches utilized for soils investigation, removal of pole foundations or other subsurface obstructions, if encountered, should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended for site fill.

3.02 GENERAL

A. Preparation of Fill Areas:

Prior to placing fill, the surfaces of all areas to receive fill should be scarified to a depth of 12" or more. The scarified soils should be brought to near optimum moisture content and recompacted to a minimum relative compaction of 90 percent in accordance with ASTM D 1557-91.

B. Preparation of Building Pad and Footing Areas:

All footings should rest upon at least 18" of properly compacted fill material or should be embedded at least 18" into approved original ground soils. The existing surface soil within the building pad area shall be sub excavated to a depth of 36" below the existing grade or 18" below the lowest foundation level (whichever is lowest) extending five feet beyond all exterior wall/column lines (including adjacent concreted areas). Exposed sub grade shall be scarified to a depth of 8"; uniformly moisture conditioned to at least 2% above optimum moisture content, and re-compacted to a minimum of 90% of the maximum density determined in accordance with ASTM D1557 methods.

Footings should not be allowed to span from native to fill soil conditions. If a native to fill soil condition should exist, footing areas shall be subexcavated and recompacted as described above so as to provide a compacted fill mat for support. If footings are to be placed entirely in suitable native soils, the footing excavations should be observed by the soils engineer prior to forming and utility installation.

C. All surfaces to receive fill which are not under foundations should be scarified to a depth of at least 12". The scarified soils shall be spread in 8" or less lifts with each lift moistened to a near optimum moisture content and compacted to a relative compaction of at least 90 percent (ASTM D-1557-70).

D. The on-site soils should provide adequate quality fill materials provided they are free from organic matter and other deleterious materials. The native soils shall be placed in maximum 8 inch lifts (loose) and compacted to a minimum of 90% of ASTM D1557 maximum dry density at least 2% above optimum moisture. Unless approved by the Soils Engineer, rock or similar irreducible material with a maximum dimension greater than 3" shall not be buried or placed in fills.

Based upon the relative compaction of the native soils determined during this investigation and the relative compaction anticipated for compacted fill soils, it is estimated a compaction shrinkage of approximately 5 to 10 percent will occur. Therefore, 1.05 cubic yards to 1.10 cubic yards of in-place soil material would be necessary to yield one cubic yard of properly compacted fill material. In addition, it is anticipated there will be subsidence of approximately 0.1'. These values are exclusive of losses due to stripping, tree removal or the removal of other subsurface obstructions, if encountered, and may vary due to differing conditions within the project boundaries and the limitations of the soils investigation.

Values presented for shrinkage and subsidence are estimates only. Final grades should be adjusted, and/or contingency plans to import or export material should be made to accommodate possible variations in actual quantities during site grading.

F. Cut and fill slopes, should be constructed no steeper than 2 horizontal to 1 vertical. Fill slopes, should be overfilled during construction and then cut back to expose.

G. Backfill any excess excavation under footings with concrete at Contractor's expense.

H. Shore and brace excavations where necessary to prevent cave-ins, and in accordance with all safety laws and codes.

I. Backfill soil within roadways shall be placed in layers not more than 6 inches in thickness and mechanically compacted to a minimum of 90% of the ASTM D1557 maximum dry density except for the top 12 inches of the backfill shall be compacted to 95%. Native backfill shall only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material. Pipe envelope/bedding material should either be clean sand (Sand Equivalent SE > 30) or crushed rock when encountering ground water. A geotextile filter fabric (Mirafi 140N or equivalent) shall be used to encapsulate the crushed rock to reduce the potential for in-washing of fines into the gravel void space. Precautions should be taken in the compaction of the backfill to avoid damage to pipes and structures.

J. Control grading around building:

1. Pitch earth to prevent water from running into excavated areas or damaging structure.

2. Maintain all pits and trenches, where footings will be placed, free of water at all times.

3. Provide all pumping required to keep excavated spaces clear of water during construction.

4. When springs or running water are encountered, notify Soils Engineer, provide free discharge of water by trenches or pumps, and drain to appropriate point of disposal as directed.

K. Pre-job Conference:

It is imperative that no clearing and/or grading operations be performed without the presence of a representative of the soils engineer. An on-site pre-job meeting with the architect, the contractor and the soils engineer shall occur prior to all grading related operations. It should be stressed that operations undertaken at the site without the presence of the soils engineer may result in exclusions of affected areas from the final compaction report for the project.

L. Construction Observation:

All grading operations, including site clearing and stripping, shall be continuously observed by a representative of the soils engineer. The presence of the soils engineer's field representative will be for the purpose of providing observation and field testing, and will not include any supervising or directing of the actual work of the contractor, his employees or agents. Neither the presence of the soils engineer's field representative nor the observations and testing by the soils engineer shall excuse the contractor in any way for defects discovered in his work. It is understood that the soils engineer will not be responsible for job or site safety on this project which will be the sole responsibility of the contractor.

3.03 SETTLEMENT

A. Any settlement in backfill or fill, which occurs during the warranty period and attributed to construction procedures, such as improper removal of shoring or insufficient compaction shall be corrected by Contractor at his own expense. Any structures, paved areas, piping or other facilities damaged by such settlement shall be restored to their condition prior to settlement by Contractor at his own expense.

3.04 LAYOUT FOR FINISH GRADING (SEE SECTION 02260)

A. Perform all finish grading required, as indicted or reasonably inferred to permit installation of work of others as shown on Drawings. At completion of work entire site shall be left in a clean and finished condition conforming to plans and specifications.

3.05 EXCAVATION ADJACENT TO EXISTING STRUCTURES

A. Since ordinary mass removal and recompaction of the soils adjacent to the existing structures, sidewalks, and masonry walls may result in unacceptable distress by the removal of bearing and lateral support, the following precautionary measures should be utilized during proposed

subexcavation/recompaction operations to minimize the potential for distress to the existing adjacent structures.

1. During compacted fill mat construction for the proposed building addition, the excavation and replacement of soils adjacent to the existing structures should be accomplished in the shortest period of time possible. Sufficient forces and equipment should be available to accomplish any removal and replacement of soils adjacent to the existing structure within one eight-hour working day. The excavation should not be performed during periods of rain or threat of rain. During the excavation operation, the moisture content of the soils near the existing structure should be monitored. If excessive moisture contents or excessively dry soils are encountered, the soils engineer should be notified immediately.

2. The actual excavation and recompaction of soils near the existing structures should be monitored by the soils engineer and the soils engineer shall make a recommendation for an excavation method to be used. As a minimum procedure, the excavation shall be performed in alternating sections. A checkerboard type system should be utilized by initially removing and re-compacting every other square and thereupon going back and removing and re-compacting the remaining square. The width of these excavations is usually equal to the blade size of the available equipment but should not exceed 12', and in any case, should not leave greater than 1/3 of the wall being subexcavated unsupported.

3. As a further precaution, the elevation of the existing structures shall be noted and monitored continuously by the contractor during the excavation operation adjacent to the existing structure. If an elevation change is noted, excavation should be suspended and the soils engineer notified at once. In addition, if significant caving occurs under existing adjacent footings, excavation should be suspended and the soils engineer notified at once.

4. Extreme caution should be exercised during the subexcavation process near the existing structures. Vibratory type compaction equipment should not be utilized. It should be emphasized that coordination between the contractor and the soils engineer will be most important during this phase of the operation.

END OF SECTION

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SECTION 02260

FINISH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all finished grading, as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. Related work specified elsewhere:

1. Earthwork: Section 02200

C. Location of work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.02 QUALITY ASSURANCE

A. Finish grading tolerance: 0.1-ft. plus/minus from required elevations.
B. Comply with SCAQMD and Rancho Mirage PM10 regulations.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 ROUGH GRADE REVIEW

A. Rough grading reviewed by Architect in Section 02200 - Earthwork.

3.02 FINISHED GRADING

A. Correct, adjust and/or repair rough graded areas.

1. Cut off mounds and ridges.

2. Fill gullies and depressions.

3. Perform other necessary repairs.

4. Bring all grades to specified elevations and contours, even and properly compacted.

5. Set finished grade down to allow for addition of D.G. or cobble for Section 02990.

B. Make finished surface free of stones, sticks, or other material 1" or more in any dimension.

C. Make finished surface smooth and true to required grades.

3.03 ACCEPTANCE

A. Upon completion of finish grading obtain Architect's acceptance of grade and surface.

END OF SECTION

SECTION 02280

SOIL TREATMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for soil treatment as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

1.02 QUALITY ASSURANCE

A. Perform work in accord with CAL-OSHA requirements and State and Local requirements.

1.03 JOB CONDITIONS

A. Protect existing facilities, utilities, (overhead and underground), sidewalks, and pavement.

1. Repair damaged items.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Soil poisoning:

1. Soil shall be treated against subterranean termites and ants by a reliable and established, licensed termite control firm thoroughly familiar with local soils and chemicals.

2. Apply an aqueous solution of TERMIDOR SC, manufactured by BASF The Chemical Co. To prepare a .06% desired finished dilution of Termidor SC, add 78 fluid oz. of Termidor SC to 99.25 gallons of water

and mix thoroughly. Apply in accordance with the manufacturer's directions on the label as follows:

a. Slab on-ground construction

(1) After all grading is completed and prior to the pouring of the slab, slab porches and entrance platforms, make the following treatments.

(a) Along both sides of foundation walls, interior foundation walls, around plumbing, piers and conduits, dig a narrow trench, not wider than 6 inches, or rod to a depth of 18", but not below the bottom of the footing. Apply 4 gallons of .06% solution per 10 linear feet per foot of depth of trench. Mix the emulsion with the soil as it is being returned to the trench. Treated soil should be returned to the trench. Treated soil should be covered with a thin layer of untreated soil.

(b) Spray 1 gallon of .06% solution per 10 square feet of earth fill that will be beneath slabs.

(2) Treat all voids in hollow masonry units of the foundation at the rate of 2 gallons of .06% solution per 10 linear feet. Overlap the deposition patterns so as to make a continuous chemical barrier in the voids, and apply the emulsions so it will reach the footing.

3. Guarantee - Treatment shall remain effective for not less than 5 years. The Termite Control Firm shall furnish a written 5-year guarantee in 3 copies stating that if at any time during the 5-year period, ground nesting occurs; treatment will be applied to exterminate all infestation without cost to the Owner.

PART 3 - EXECUTION

3.01 PREPARATION

A. All areas to be beneath slabs on grade shall be stripped of any deleterious materials. These materials should be removed from the site for disposal.

3.02 APPLICATION OF SOIL POISONING

A. Per manufacturer's specifications.

END OF SECTION

SECTION 02513

ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Provide base course asphaltic concrete paving, weed killer, and sealer where shown on the drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Work:

1. Documents affecting this Section include, but are not necessarily limited to General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

2. Section 02222, Building Excavation, Filling and Backfilling.

1.02 QUALITY ASSURANCE

A. Use adequate number of skilled workman who are thoroughly trained and experienced in the necessary craft and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

1.03 STANDARDS

A. References herein to State Standard Specifications are to the Standard Specifications of the Department of Transportation, State of California (Caltrans), latest Edition.

B. References herein to Standard Specifications are to the Standard Specifications for Public Work Construction, prepared by the Southern California Chapters of the American Public Works Association and The Associated General Contractors of America, 1985 Edition.

1.04 GUARANTEE

A. Submit one year guarantee in accordance with and in form required in Division 1. Guarantee shall include bringing to grade and repairing of defective surfacing due to grade settlement of fills, trench fills, or any portion of base or surfacing.

PART 2 - PRODUCTS

1/11/2011 3.30

2.01 PAVEMENT SYSTEM

A. Pad under relocatable units:

1. Native subgrade: 90% compaction
2. Base: 2-1/2"; 95% compaction
3. Asphaltic Concrete: 3 inches
4. Sealer: Fog Seal

2.02 AGGREGATES

A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable, mineral materials processed and blended, and naturally combined.

B. Base aggregate: State Standard Specifications, Section 26, Class 2, maximum size:

1. Base courses over 6 inches: 1-1/2 inch.
2. Other base courses: 3/4 inch.
3. The aggregate base shall also have a sand equivalent value of not less than 30 when tested in conformance with Test Method No. California 217.

C. Aggregates for asphaltic concrete paving: Standard Specifications Section 203-6, Type I - Class C (1/2") for 1-1/2" lifts. Aggregate shall be Type I - Class D (3/8") for 1" lifts.

2.03 ASPHALTS

A. Asphalt concrete pavement shall comply with Section 203-6 and 302-5 of the Standard Specifications, except that asphalt concrete shall not be placed when the atmospheric temperature is below 50 degrees F. Paving asphalt shall be AR 4000.

B. Comply with provisions of Standard Specifications, Section 302-5.

1. Asphalt cement: Penetration grade 50/60.
2. Prime Coat: SC-70 Liquid Asphalt.
3. Tack Coat: Uniformly emulsified, grade SS-1H.

2.04 MIXING ASPHALTIC CONCRETE MATERIALS

A. Provide hot plant mixed asphaltic concrete paving materials in accordance with Standard Specifications, Section 203-6.

1. Temperature leaving the plant: 290 degrees F. minimum, 320 degrees F maximum.

2. Temperature at time of placing: 280 degrees F minimum.

2.05 WEED KILLERS

A. Provide a dry, free-flowing, dust-free chemical compound containing not less than 30% sodium chlorate or a chlorateborate compound, non-flammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.

B. Acceptable products:

1. "Spike 80W": California Weed Control Industrial Co., Upland, CA.

2. Acceptable substitution products of other manufacturers when accepted in advance by the Architect.

2.06 HEADERS AND STAKES

A. Provide Redwood, Construction grade, in dimensions shown on the Drawings or as required for the use where dimensions are not shown on the Drawings.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINAL PREPARATION OF SUBGRADES

A. After preparation of subgrade as specified in another Section of these Specifications, thoroughly scarify and sprinkle the entire area to be paved, and then compact to a smooth, hard, even surface of 90% compaction to receive the base aggregates or 95% to receive the asphaltic concrete.

B. Apply the specified weed killer to the entire area to be paved. Adhere to the manufacturer's application recommendations.

3.03 PLACEMENT OF BASE COURSE

A. Base:

1. The aggregate base material shall be spread as specified in Section 26-1.035 and 26-1.04 of the State Standard Specifications. The aggregate base material shall be compacted as specified in Section 26-1.05 of the State Standard Specifications.

2. Spread the specified base material to a thickness providing 2-1/2 inch minimum thickness unless otherwise noted.

3. Compact to 95%.

B. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0" to plus 0.5".

C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/8" in ten feet.

1. Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required.

D. Moisture content: use only the amount of moisture needed to achieve the specified compaction.

3.04 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. The method of depositing, distribution and rolling the asphalt concrete shall be in accordance with Sections 302-5.4 and 302-5.5 of the State Standard Specifications.

B. Install the specified headers and stakes to achieve the arrangement of paving shown on the Drawings.

C. Remove all loose materials from the compacted base.

D. Apply the specified prime coat, and tack coat where required, Standard specification, Sections 302-5.2 and 302-5.3, and allow to dry.

E. Adjust frames and covers, if so required, to meet final grades.

F. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.

2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F. nor during fog, rain, or other unsuitable conditions.

G. Spreading:

1. Spread material in a manner which required the least handling.

H. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the Drawings.

2. Roll in at least two directions until no roller marks are visible.

3. Finished paving smoothness tolerance:

a. Free from birdbaths.

b. No deviations greater than 1/8" in six feet.

3.05 FLOOD TEST

A. Prior to application of seal coat, perform a flood test in the presence of the Architect.

B. Method:

1. Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.

2. If a depression is found where water ponds to a depth of more than 1/8" in six feet, fill or otherwise correct to provide proper drainage.

3. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

3.06 APPLICATION OF SEAL COAT

A. Prepare the surfaces, mix the seal coat material, and apply in accordance with State Standard Specifications, Section 302-4.

B. Apply one coat of the specified sealer.

C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

3.07 PROTECTION

A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

END OF SECTION

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SECTION 02518

SOLID CONCRETE INTERLOCKING PAVERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and place sand laying course.

B. Furnish and install interlocking concrete pavers in the quality, shape, thickness and color as specified.

C. Furnish and install all accessory items as required by the Contract.

1.02 RELATED WORK

A. Preparation of sub-base - see Section 02200.

B. Furnish and install base course materials - see Section 02520.

1. Provide an aggregate sub base of a minimum of 4" in accordance with paragraph 5.9 of the Soils Report in Section 00220.

1.03 REFERENCES

A. ASTM C936 - "Standard Specification for SOLID CONCRETE INTERLOCKING PAVING UNITS".

B. NCMA-TEK, TEK 87 - "Construction of Concrete Masonry Pavement".

1.04 SUBMITTALS

A. Manufacturer's product data.

B. Documentation of installer's experience.

C. Manufacturer's installation instructions.

D. Six pavers of each color.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacturing of solid concrete interlocking pavers for a period of 5 years. Single layer production only, multi layer production is unacceptable.

1.06 MOCK-UPS

A. Provide mock-up of pavers under the provisions of Section 01340.

B. Size of mock-up shall be determined based on extent of pattern to be adequately shown.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver pavers in such a manner that no damage occurs during shipping, handling, unloading, and storage.

1.08 PROJECT CONDITIONS

A. Install pavers only under conditions stipulated in manufacturer's instructions.

1.09 SEQUENCING AND SCHEDULING

A. Coordinate installation of pavers with work scheduled in Section 01310.

1.10 WARRANTY

A. Installation:

1. Installer shall provide a one (1) year written guarantee.

B. Pavers:

1. Manufacturer shall provide a one (1) year written guarantee.

PART 2 - PRODUCTS

2.01 MANUFACTURER (ONE OF THE FOLLOWING SHALL BE SELECTED)

A. Ackerstone Co, 13296 Temescal Canyon Road, Corona, CA 91719

1. Style: Either the "Octo-Stone" or "Uni-Decor". Not Both.

2. Thickness: 2-3/8" (6 cm).

3. Color: Both style choices shall be supplied in a color blend of 50% Buff and 50% Terra Cotta.

B. Orco Block Co., Banning, CA.

1. Style: Barcelona.

2. Thickness: 2-3/8" (6cm).

3. Color: A color blend of 50% Creme and 50% Terra Cotta.

2.02 MATERIALS

A. Pavers:

1. Cementitious Materials:

a. Portland Cements shall conform to ASTM Specification C-150.

2. Aggregates:

a. Aggregates shall conform to ASTM Specification C-33 for Normal Weight Concrete Aggregate (no expanded shale or lightweight aggregates) except that grading requirements shall not necessarily apply.

3. Other Materials:

a. Coloring pigments, air entraining agents, integral water repellents, finely ground silica, etc., shall conform to ASTM standards where applicable, or shall be previously established as suitable for use in concrete.

B. Sand Laying Course:

1. The sand laying course shall be well-graded, clean, washed sand with 100% passing a 3/8" sieve size and a maximum of 3% passing a No. 200 sieve size.

2. Use concrete sand, limestone screening, or similar. Do not use mason sand.

3. The sand laying course is the responsibility of the paving stone installer.

C. Edge Restraint:

1. All edges of the installed pavers shall be restrained. The type of edge restraint shall be approved at locations and per details noted on plans.

2. Edge restraint shall be:

a. Concrete curb or sidewalk (cast-in-place).

b. Other suitable methods of preventing movement of edge pavers.

2.03 PHYSICAL REQUIREMENTS

A. Compressive Strength:

1. At the time of delivery to the work site, the average compressive strength shall not be less than 8,000 psi with no individual unit strength less than 7,200 psi, with testing procedures in accordance with ASTM Standard C-140.

B. Absorption:

1. The average absorption shall not be greater than 5% with no individual unit absorption greater than 7%.

C. Proven Field Performance:

1. Satisfying field performance is indicated when paving units similar in composition, and made with the same manufacturing equipment as those to be supplied to the Owner, do not exhibit excessive deterioration after at least one (1) year.

2.04 VISUAL INSPECTION

A. All units shall be sound and free of defects that would interfere with the proper placing of unit or impair the strength or permanence of the construction.

B. Minor cracks incidental to the usual methods of manufacture, or chipping resulting from customary methods of handling in shipment and delivery, may be deemed grounds for rejection.

2.05 SAMPLING

A. The Owner or his authorized representative shall be accorded proper facilities to inspect and sample the units at the place of manufacture from lots ready for delivery.

2.06 REJECTION:

A. In the event the shipment fails to conform to the specified requirements, the manufacturer may sort it, and new test units shall be selected at random by the Owner from the retained lot and tested at the expense of the manufacturer. If the second set of test units fails to conform to the specified requirements, the entire lot shall be rejected.

2.07 EXPENSE OF TESTS

A. The expense of inspection and testing shall be borne by the Owner unless otherwise agreed.

PART 3 - EXECUTION

3.01 PREPARATION

A. A minimum aggregate base of 4" shall be prepared as specified in related sections of this specification. (See Section 00220 paragraph 5.9)

B. The base course shall be shaped to grade and cross section with an allowable tolerance of 1/4" (5mm) (relative to specified dimensions below finish design elevation).

C. The top of the compacted base shall be 3-3/8" (86mm) below final grade for 2-3/8" (6cm) pavers.

3.02 SAND LAYING COURSE

A. Contractor shall inspect and approve the finished base course prior to placement of the sand laying course.

B. Spread the sand evenly over the area to be paved.

C. Screed the sand to a level that will produce a 1" (25mm) thickness when the paving stones have been placed and vibrated.

D. In addition, provide the proper level of sand such that the final elevation of paving stones will be nominally 1/4" to 3/8" higher than the adjacent curb, gutters, other paving, etc., to allow for free drainage from chamfers on block edges.

E. Do not disturb this sand laying course once screeding and leveling to the desired elevation is achieved.

3.03 PLACEMENT

A. The pavers shall be placed in the approved pattern as noted or shown on the drawings.

B. The pavers shall be placed in such a manner that the desired pattern is maintained and the joints between the pavers are nominally 1/8" with no individual gap exceeding 1/4".

C. Use string lines to hold all patterns true.

D. The gaps at the edge of the paver surface shall be filled with standard pavers or with pavers cut to fit.

E. The cutting of pavers, using a doubleheaded breaker or a masonry saw, shall leave a clean edge to the traffic surface.

F. When cutting precision designed areas, a masonry saw shall be used.

G. Pavers to be alternately selected from at least three (3) pallets, working from top to bottom in each pallet stack.

H. Pavers shall be vibrated into the sand laying course using a vibrator capable of 3,000 to 5,000 pounds compaction force with the surface clean and the joints open.

I. After vibration, clean masonry type sand containing at least 30% of 1/8" (3mm) particles shall be spread over the paving stone surface, allowed to dry, and vibrated into the joints with additional vibrator passes and brushing so as to completely fill the joints.

J. Surplus material shall be left on the surface during construction to insure complete filling of the joints during initial use. This sand may also provide surface protection from construction debris. Any surplus at completion shall be swept from the surface.

K. Upon completion of work covered in this section, the Contractor shall clean up all work areas by removing all debris, surplus material and equipment from the site.

END OF SECTION

SECTION 02520

CONCRETE PAVING AND CURBS

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for concrete paving and curbs, as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

1.02 QUALITY ASSURANCE

A. Construction minimum standards: "Standard Specifications for Public Works Construction", latest edition.

B. Should conflicts arise between standard specifications of government agencies mentioned herein and Contractor Documents, Contract Documents shall govern.

C. Where a particular type of material or method is specified, no other type of material or method will be permitted.

1.03 SUBMITTALS (SEE SECTION 01340)

A. Product data:

1. Concrete mix design. (Per Section 01400 - General Testing Procedures).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete (air-entrained):

1. For walk paving: Class B.

2. For curbs: Class A.

B. Aggregate base: Class 2, in accord with Section 26 of State Specifications.

C. Expansion joint filler: ASTM D545, flexible foam, Sonneborn "Sonoflex F" or W.R. Meadows "Ceramar", 1/2" thick.

D. Sealant: F.S.TT-S-00227E, type 1, class A, polyurethane type: Use self-leveling type for horizontal joints and gun-grade, non-sag type for vertical joints - gray color.

E. Moisture barrier: Visqueen, 6 mil thickness.

PART 3 - EXECUTION

3.01 CONSTRUCTION - GENERAL

A. Construct to line and grade indicated. Construct in accord with the City of Indian Wells Standards and Standard Specification.

3.02 CONCRETE WALK PAVING

A. On properly compacted subgrade, install continuous layer of moisture barrier, overlapping all edges minimum of 12".

B. On properly installed moisture barrier, install 2" layer of aggregate base. Compact aggregate base to 90 percent relative compaction as determined by Test Method No. California 216. Thoroughly water after placing.

C. On properly installed and compacted aggregate base, install 4" layer of concrete.

1. Place all paving 1/4" above top of future curb.

2. Slope surface at 1/4" per ft. (1:50) transversely toward future curb.

3. Finish/Color: Wood float, non-directional, uniform with salf finish. Color to be gray.

D. Provide weakened plane (contraction) joints where indicated.

E. Provide expansion joints where indicated and where walks meet other structures.

1. Expansion joints at 24 ft. on center maximum.

2. Set joint filler to within 1/2" of surface.

3. Do not seal transverse joints of single width walks. Seal all other joints.

3.03 CONCRETE CURBS

A. Provide as detailed on drawings.

B. Provide weakened plane (contraction) joints at 10 ft. on center maximum with metal templates or saw cutting.

1. Saw cut depth to be 1/4 of curb thickness.

2. Cut top and face of curb.

C. Provide expansion joints, 3/4" at 100 ft. on center maximum.

D. Do not seal joints.

END OF SECTION

SECTION 02720

STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all storm drainage systems as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. All excavation is unclassified.

C. Definitions:

1. Engineer: Soils Engineer employed by Owner, empowered to conduct and make approvals.

2. Unclassified excavation: Excavate and grade all materials.

1.02 QUALITY ASSURANCE

A. Storm drainage system standards: State of California, Department of Transportation, "Standard Specifications", July '84, as amended to date.

B. Should conflicts arise between standard specifications of government agencies mentioned herein and Contract Documents, Contract Documents shall govern.

C. Where a particular type of material or method is specified, no other type of material or method will be permitted, except as described in Section 01640, but the balance of State Specifications shall apply.

D. Compaction density test: Modified Proctor ASTM 01557-78.

E. Owner will hire an independent soils laboratory to conduct in-place moisture and density tests.

1. Contractor to pay for retests of material not passing initial tests.

F. AASHTO and ASTM standards indicated.

1.03 JOB CONDITIONS

A. Lengths indicated on drawings are for information only. Furnish lengths as required.

B. Perform no pipe work in fill areas until embankment or fill has been completed to at least 2 ft. above top of pipe and has been properly compacted.

C. Verification of existing utilities and structures.

1. Plans indicate existing utilities as shown on site survey.

2. Verify accuracy, location and depth of each utility prior to open cut trenching or tunneling.

3. If pipe adjustment is necessary due to location of other utilities, secure approval from Architect/Engineer.

D. Revisions to Contract Drawings.

1. If it becomes necessary to change location of storm drainage lines due to building construction, secure approval of Architect/Engineer.

2. If contractor initiated, make approved changes without added cost to Owner.

E. Do not change pipe sizes without securing written approval of Architect/Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Acceptable manufacturers:

1. All pipe and fittings: Manufacturer who has produced pipe successfully used, for at least 5 years.

B. Vitrified clay pipe, extra strength (VCPX):

1. Pipe and fittings: ASTM C700-78a.

2. Laying length of 3, 4, or 5 ft.

3. Actual internal diameter of vitrified clay piping not less than nominal diameter of pipe as indicated.

4. Joints: Compression type, removable rubber gaskets, ASTM C425-77.

C. Concrete: Class A, air entrained.

D. Backfill material: As approved by Engineer.

1. Free of rock cobbles, roots, sod or other organic matter, and frozen material.

2. Moisture content at time of placement: 2 percent plus/minus of optimum moisture content, as tested in accord with ASTM D1557-78.

a. Add water to dry material, as required.

b. Allow wet material to dry, as required or furnish off-site material at no additional cost to Owner.

PART 3 - EXCAVATION

3.01 EXCAVATION, BACKFILL AND COMPACTION

A. Excavate trenches by open cut method to depth indicated on plans and necessary to accommodate the work.

B. Open no more than 300 LF of trench at one time, or less as required by Engineer.

C. Keep trenches free of water.

D. Form bell holes in trench so only barrel of pipe is firmly supported by shaped subgrade.

E. Tamp backfill under and around pipe up to 24" above top of pipe in lifts not exceeding 8" loose thickness.

F. Backfill and compact remainder of trench in 8" lifts to density specified.

G. Tamp evenly on both sides of pipe to top of excavation or to a depth such that pipe will not be damaged by subsequent compaction used to achieve required density.

H. Exercise care in backfilling operations to avoid displacing pipe joints either horizontally or vertically and to avoid breaking pipe.

I. Do not water flush for consolidation.

J. Compact all trench backfill in areas under paved areas and other structures to minimum of 95 percent Modified Proctor.

K. In locations where trench will not be under paved areas or structures, compact to minimum of 90 percent Modified Proctor.

L. Remove materials which cannot be compacted as specified and replace with suitable material.

3.02 INSTALLATION OF PIPE

A. Lay pipelines on uniform grades between inverts.

B. Locate structures as indicated and construct lines between them.

C. Lay pipe upgrade beginning at lower end.

D. Provide proper facilities for lowering sections of pipe into trenches.

E. Do not lay pipe in water.

F. Do not lay pipe when trench conditions or weather is unsuitable for such work.

G. Remove any section of pipe already placed which is found to be out of alignment, defective or damaged. Relay or replace as directed, without additional cost to the Owner.

H. Bedding: Lay pipe directly on shaped subgrade.

1. No blocking permitted.

2. Form a continuous bearing with a minimum width of bearing equal to six tenths (0.6) of outside diameter of pipe, for full length of pipe, except for portion at hole excavated for joint.

3.03 DRAINAGE STRUCTURES

A. Concrete work: Conform to applicable requirements of State Specifications. Form, size, and brace so finished structures conform to details indicated.

3.04 FIELD QUALITY CONTROL

A. Check each line with a light. Each line shall show a good light circle throughout its length.

B. Test pipe, fitting and joints for leakage and infiltration.

C. Should these tests show line to be defective, remove defective portion and replace.

D. Retest.

END OF SECTION

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Project #0901.00

SECTION 02810

AUTOMATIC IRRIGATION SYSTEM

Conditions of the Contract and Division 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, supplies, tools and transportation and perform all operations for the complete installation of the irrigation system as shown on the drawings and herein specified.

B. The work shall include but shall not necessarily be limited to the following:

1. Ordering, furnishing, and installing materials for complete system including piping, valves, fittings, backflow preventor, sprinkler heads, automatic controller, and final adjustment of heads, to insure complete coverage.

2. Trenching, stockpiling excavation materials and refilling trenches, including compaction of back fill and installation of sleeves.

3. Line voltage connections to the irrigation controllers and low voltage control wiring from controllers to remote control valves.

4. Replacement of unsatisfactory materials.

5. Clean-up, inspection and approval.

6. Operational tests.

7. "As built" record drawings, shop drawings, warranties and guarantees.

1.02 RELATED WORK

A. Underground site utility, electrical work, landscape planting, paving, masonry walls, plumbing, grading and drainage.

1.03 REGULATIONS, PERMITS, FEES, LICENSE AND INSURANCE

A. Obtain and pay for all permits and pay all inspection, connections, and other fees. (Furnish acceptance certificates to Architect along with "as-built" drawings).

B. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code, published by the Western Plumbing Officials Association; and other applicable State or local laws or regulations. Nothing in these Drawings or Specifications is to be construed to permit work no conforming to these codes.

1. When the Specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the Specifications shall take precedence over the requirements of the said rules and regulations. The Contractor shall furnish without any extra charge any additional material and labor when required by the compliance with these rules and regulations, though the work be not mentioned in these particular Specifications or shown on the Drawings.

2. The Contractor shall erect and maintain barricades, guards, warning signs, and lights as necessary or require for the protection of the public or workmen.

3. Any existing buildings, equipment, piping, pipe covering, sewers, sidewalks, landscaping, etc. should be located and protected prior to commencing work. Damage by the Contractor during the course of his work shall be replaced or repaired by the Contractor in a manner satisfactory to the Architect, and at the Contractor's own expense, and before the final payment is made.

4. All work shall be performed by a C-27 California Licensed Landscape Irrigation Contractor.

5. The Contractor shall carry all worker's compensation, public liability and property damage insurance as required by public codes and the General Contractor.

6. Water and Work Space: Water is available at the site without cost. Make and remove all temporary lines and connections.

7. Disruption of Services: Permission to shut off any water lines must be obtained from the Construction Supervisor, who will make the necessary arrangements. Disruption in existing systems shall be kept to a minimum.

8. Verification of Finish Grade: Verify the correctness of all finish grades within the work areas in order to insure the proper soil coverage (as specified) of the sprinkler system pipes.

1.04 VISIT TO THE SITE

A. The Contractor shall visit the construction site and shall take all measurements and obtain any other information as may be necessary for a complete and conclusive bid. Existing irrigation system that can be used shall be considered on the bid.

1.05 LAYOUT OF WORK

A. The Contractor shall stake out the irrigation system as shown on the Drawings. These areas shall be checked by the Contractor and the Architect before construction is started. Any changes, deletions or additions shall be determined at this check. No walks or paved areas shall be sprinkled. The drawings are schematic only unless specifically dimensioned. Check all drawings and make this work conform to all conditions shown thereon. Exact locations shall be determined on the job to suit the actual conditions; verify with Architect any variations. Do not scale drawings. Locations so determined are the Contractor's responsibility and changes required because of such actions shall be by the Contractor at no extra cost to the Owner. Drip irrigation laterals to be installed after plants are installed. Any pipes interfering with plant locations shall be moved at the Contractor's expense.

1.06 SUBSTITUTIONS

A. Any substitutions shall be approved by the Architect in writing prior to installation. See Section 00440, Substitutions Prior to Bidding and Section 01640, Substitutions After Execution of Contract.

1.07 SUPERVISION AND WORKMANSHIP

A. The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall as far as possible keep the same foremen and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job.

PART 2 - MATERIALS

2.01 MATERIALS

A. Plastic Pipe

1. Extruded from 100% virgin polyvinyl chloride (PVC). Outside diameter of plastic pipe shall be the same size as iron pipe, with plain ends. All pipe and fittings shall be in accordance with the Society of Plastic Industry Standards and National Sanitation Foundation.

2. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name, normal pipe size; PVC type, S.D.R. or pressure rating; and extrusion date.

3. Plastic pipe shall be delivered to the site in unbroken bundles, packaged in such a manner as to provide adequate protection for the pipe ends, threaded or plain.

4. Main lines (constant pressure) shall be polyvinyl chloride (PVC) 1120 - SCH. 40 IPS plastic pipe with Schedule Type 1, Grade 1 PVC weld fittings.

5. Connections between main lines and remote control valves shall be of schedule 80 PVC (threaded both ends) nipples and fittings.

6. Risers shall be as shown in the construction details, if applicable.

7. Sleeves shall be schedule 40 PVC and be two sizes larger than piping.

B. Plastic Fittings and Connections

1. Fittings shall be of polyvinyl chloride (PVC), Type 1, Schedule 40, N.S.F. and of IPS solvent welded or screwed type, Lasco, Sloane or equal (same manufacturer as of pipe).

2. Plastic to plastic joints shall be solvent-weld joints. Pipe solvent shall be Johns-Manville "Blue" solvent weld cement. (No substitutions)

3. Plastic to metal joints shall be made with male adapters. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Permatex Type II. (Only Schedule 80 plastic pipe may be threaded).

4. Street elbows shall be Schedule 40 Marlex, unless otherwise noted on plans.

C. Steel Pipe and Fittings

1. Steel pipe shall be Schedule 40 galvanized steel with 150 pounds galvanized malleable fittings. All pipe shall be machine wrapped wit Johns-Manville "Printed Trantex" using a single wrap 20 mil thick with 1/2" overlap on straight pipe and two wraps of 10 mil tape on fittings and field joints.

D. Automatic Controller

1. Provide and install automatic irrigation controller in location shown on drawings. Final location shall be verified with Architect prior to installation. Provide conduit and wire and connect to 120 volt switch accessible to controller for ease of maintenance. Clock and valves shall be permanently marked and small map placed in clock.

E. Valves

1. Valves shall be globe type of size, make and catalog numbers as designed on drawings and conform to controllers. Valves shall be all brass construction (unless specified otherwise) and shall have a slow closing feature, with a manual control stem. Each valve shall be able to operate manually without electrical connection to the controller.

2. Valve boxes shall be Carson No. 910 or 1419 series or equivalent with lid marked "irrigation control valve." Install 2" above grade in ground cover area. Install clean gravel in bottom.

F. Control Wire

1. Control wire shall be UL-approved for direct burial in ground, size #14-1 minimum with maximum voltage drop of 5% between valve and controller. Common ground wire shall have white insulating jacket; control wire shall have jacket of color other than white. Splices shall be made with #2006-S Buchanon splice caps and 3M #3576 Scotchlok seal packs.

G. Backflow Preventor

1. Provide and install backflow protection unit per State and local Health Department codes. Unit shall be located in such a manner as to allow for screening by plant material. Refer to plan for schematic location. Refer to detail for further information.

H. Equipment

1. Provide all equipment called for by the Drawings, and provide to the Architect, at completion of the Maintenance period, three (3) each of all operating and servicing keys, wrenches and screw drivers required for complete maintenance and operation of all heads and valves. Include all wrenches necessary for complete disassembly of all heads and valves.

2. All equipment shall be as listed in legend, details, and specifications. Any substitutions shall be approved by Architect and Owner's Representative in writing. Any unspecified equipment shall be replaced at Landscape Contractor's expense.

I. Emitters:

1. Install emitters two inches (2") above finish grade. Any emitter left at an unacceptable height shall be re-installed at no cost to the Owner

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Schedule and coordinate placement of materials and equipment in manner to effect earlier completion of work in conformance with construction and progress schedule.

2. Protect work and materials from damage during construction and storage.

3. Handle plastic pipe carefully; especially protect it from prolonged exposure to sunlight.

4. Layout work as accurately as possible in accordance with diagrammatic drawings.

5. Where site conditions do not permit locating piping, valves and heads where shown, notify Architect immediately and determine relocation in joint conference.

6. Run pipe lines and automatic control wiring in common trenches wherever practical.

B. Excavating and Trenching

1. Excavation shall be open vertical construction ample in size to permit the pipes to be laid at the elevations intended and to permit ample space for joining. Trenches for pipe shall be cut to required grade lines, and compacted to provide an accurate grade, without noticeable settlement, and uniform bearing for the full length of the line.

2. Make trenches for pipe lines deep enough to provide minimum cover from finish grade as follows:

a. 24 inch minimum cover over main lines to control valves.

b. 24 inch minimum cover over control wires from controller to valves.

c. 12 inch minimum cover over RCV-controlled lines in planters to sprinklers if so indicated on plans.

3. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstruction. Remove caps or plugs only when necessary to continue assembly.

C. Joining of Pipe

1. The Contractor is responsible to be familiar with any and all methods of assembling, joining, and installation of the various types of pipe to be used. He will adhere in strict accordance with manufacturer's recommended guide.

2. All pipe shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed. All changes in direction of pipe shall be made with fittings.

3. Reducer tees shall be used at all sprinkler risers where a pipe size changes. Bushings shall not be allowed where reducer tees may be used. PVC saddles shall not be allowed.

4. Solvent-weld Joint:

a. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fitting of dirt, dust and moisture.

b. Dry-insert pipe into fitting to check for mis-sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.

c. Coat the inside socket surface of the fitting and the external surface of the male end of the pipe with cement. Apply a second coat of cement to the pipe end.

d. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment properly without strain to either.

e. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.

5. Threaded Joint:

a. Field-threading of plastic pipe or fittings is not permitted. Factory-formed threads only will be permitted.

b. Factory-made nipples shall be used wherever possible. Field-cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading, cut threads accurately on axis with sharp dies.

c. All threaded joints shall be made up with pipe joint compound. Apply compound to male threads only.

d. Where assembling metallic pipes to metallic fitting or valve, no more than three (3) full threads shall show when joint is made up.

e. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.

f. Where assembling soft metal (brass or copper) or plastic pipe, use strap type friction wrench only; do not use metal-hawed wrench.

D. Remote Control Valve Installation

1. Valves are shown schematically on plan and location shall be verified with Architect in field. Install valves no farther than 12 inches from main line unless absolutely necessary.

2. Thoroughly flush main line before installing valve. No soil will be allowed in valve boxes. Install gravel in valve box as shown in details.

E. Automatic Control Wiring

1. Run lines along mains wherever practical. Tie wires in bundles with pipe wrapping tape at 10 foot intervals and allow slack for contraction between strappings. Loop a minimum of three (3) feet of extra wire in each valve box; both control wire and ground wire. Tie a 20" loop in all wiring at changes of direction greater than 30'. Untie all loops after all connections have been made.

2. Connections shall be made by crimping bare wires with brass connectors and sealing with epoxy resin sealer packs. Splicing will be permitted only on runs exceeding 500 feet. Locate all splices at valve locations.

F. Automatic Controller

1. Locate controller in general location shown with exact placement to be determined by the Architect. Connect control lines to controller in sequential arrangement according to assigned identification number of

valve. Control lines shall be labeled, on controller and valve box lid, indicating number of valve controlled.

G. Inspection and Tests

1. Notify the Architect at least 48 hours in advance of inspection request and testing.

2. As soon as the mains are connected, flushed and complete, all of the outlets shall be closed and thoroughly tested under the pressure of the existing street system, in the presence of the Architect. No mains shall be covered until they have been inspected and approved by the Architect.

3. Entire system shall be capped and pressurized to 100 psi and shall remain so for a two hour period. Check all joints and connections for leaks. Repair as necessary.

4. Tests shall be observed and approved by the Architect prior to backfill.

H. Backfilling

1. Backfill shall not be placed until the installed Irrigation System has been inspected, approved, and tested in the presence of Architect. Backfill material shall be an approved sandy soil or sand. Unsuitable material, including clods and rocks over 2-1/4 inches in size, shall be removed from the premises and disposed of legally at no cost to the Owner. (Install sand bed 2" below pipe and 4" above if soil conditions are rocky).

2. All backfilling shall be done carefully and shall be properly tamped to 98% compaction and 95% for top 6" of backfill under paving. Compaction of 90% in planters is adequate with the top 12" being top soil.

3. Surplus earth remaining after backfilling shall be disposed of legally off the premises.

4. Where excavating or "jacking" is required under pavement, care shall be taken in backfilling with sand, tamping, and inundating with water.

5. If settlement occurs along trenches, and adjustments in pipes, valves and sprinkler heads, soil, sod or paving are necessary to bring the system, soil, sod or paving to the proper level of the permanent grade, the Contractor, as part of the work under this Contract, shall make all adjustments without extra cost to the Owner.

6. It is recommended that backfill be made first thing in the morning while pipe and soil temperatures are approximately the same. If backfilling is

required during heat of day, water shall be run through PVC to cool for contraction of pipe.

I. Sprinkler Head Installation

1. After all sprinkler piping and risers are in place and connected, and prior to the installation of sprinkler heads, control valves shall be opened and water used to flush out the system.

2. Drip heads above grade shall be installed at their permanent elevation on the up-hill side of plant. Sprinkler heads along walks or curbs shall be installed at their permanent elevation, flush with finish grade at the time of installation. Any adjustment necessary due to settlement will be made during maintenance period.

3. Sprinkler head adjustments shall be made by fully opening the sprinkler farthest from the control valve. The manual adjustment of the control valve shall be opened slightly to obtain a 12-inch high spray at the sprinkler mentioned above. After this condition has been met, all other sprinklers in the section shall be adjusted for equal height sprays, regulating the control valve as required to maintain this condition. With a pressure gauge on the sprinkler first opened, the control valve shall be adjusted to obtain the catalog rated pressure for the sprinkler installed. Individual heads shall then be rotated, as required to keep sprays within the areas of planting. Required for overhead sprinkler spray system only.

J. Coverage Test

1. When the sprinkler system is completed, the Contractor, in the presence of the Architect shall perform a test which indicates the water coverage afforded the planting areas is complete, adequate, and does not sprinkle any walks or paved areas. The Contractor shall furnish all materials and perform all work required to correct any inadequacies disclosed. The Contractor shall inform the Architect of any deviation from the plan required due to wind, planting, soil or site conditions, that bear on complete coverage.

3.02 GUARANTEE

A. The entire sprinkler system work shall be guaranteed for a period of one (1) year from the date of acceptance of the work. Should any trouble develop within the time specified due to inferior or faulty material or workmanship, the trouble shall be corrected by the Contractor without expense to the Owner.

3.03 RECORD DRAWINGS

A. The Contractor shall maintain in good order in the field office one complete set of "pink" bond prints of all sprinkler drawings which form a part of the Contract, showing all water lines, sprinklers, valves and controller. The drawings shall be marked "Record Drawings". In the event any work is not installed as indicated on the drawings, such work shall be corrected and dimensioned accurately from the building walls on these record drawings including proper depths.

B. Upon completion of the work, obtain (2) two sets of "pink" bond prints from the Architect and neatly correct the prints to show the "as-built" conditions, and supply 2 sets to the Architect. The Contractor shall pay for the cost of all prints.

3.04 INSTRUCTION

A. After the system has been installed and approved, the contractor shall instruct the Owner in complete operation and maintenance of the irrigation system.

3.05 CLEAN-UP

A. Remove all debris, dirt, rocks, trash, etc. from paving, sidewalks, and other non-planter areas. Be prepared to wash all paved areas clean with either a water truck or fire hose or other large suitable equipment capable to accomplishing the work quickly.

END OF SECTION

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Project #0901.00

SECTION 02900

LANDSCAPING

Conditions of the Contract and Division 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.01 SCOPE

A. The work of this section shall include all labor, materials and equipment required to complete the landscaping work indicated on the drawings and herein specified.

B. The principal items consist of:

1. Submittals
2. Materials including, but not limited to:
   a. Topsoil, fertilizers and soil amendments
   b. Herbicides
   c. Planting materials and accessory items
3. Plant Installation
4. Plant maintenance for a period of 90 days per this specification
5. Guarantee
6. Fine grade all areas to be landscaped including earth berms
7. Placement of cobble and decomposed granite

1.02 RELATED WORK

A. Other related work not covered in this section may include, but not be limited to:

1. Underground site utilities
2. Automatic irrigation system
3. Paving

4. Hardscape

5. Drainage

6. Rough grading

1.03 VISIT TO THE SITE

A. The Contractor shall visit the site, review the plans and specifications and shall take all measurements and obtain any other information as may be necessary for a complete and conclusive bid. All irrigation systems shall be inspected and approved by Landscape Architect before start of any work of this section.

1.04 PERMITS, FEES, REGULATIONS, LICENSE AND INSURANCE

A. Landscape Contractor shall obtain and pay for all permits and fees and agency inspections as required including Agricultural Department and submit all acceptance certificates to the Landscape Architect.

B. All work, materials, and installation shall comply with pertinent codes, regulations, and industry standards.

C. The Landscape Contractor shall be currently licensed as a C-27 California Landscape Contractor and shall show proof of licensing in the city where work is being performed.

D. Contractor shall carry all worker's compensation, public liability, and property damage insurance as required by public codes and the General Contractor.

1.05 SUPERVISION AND WORKMANSHIP

A. The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly. The supervisor shall always maintain a safe and reasonably clean work area, and the workmanship of the entire job shall be first class in every aspect.

B. The Contractor shall be responsible for the protection of private property at and adjacent to the Work area and shall exercise due caution to avoid damage to such property.

C. Trees, lawns, and shrubbery that are not to be removed shall be protected from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in as nearly the original conditions and location as is reasonably possible. Replaced lawns shall be sodded, not seeded.

1.06 SUBMITTALS BY LANDSCAPE CONTRACTOR (SEE SECTION 01340)

A. Soil Tests

It is the responsibility of the Landscape Contractor to inform the Landscape Architect of any adverse soil conditions on site. To insure proper soil conditions for planting, the Landscape Contractor shall submit several soil samples, randomly collected from the site, and sent to Soil and Plant Laboratory in Santa Ana, CA (714) 558-8333 for testing and analysis. Results of testing shall be delivered to the Landscape Architect for approval prior to commencing with soil preparation.

B. Plant Availability List

Within 30 days of signing the contract, the Landscape Contractor shall provide the Landscape Architect with a complete materials list of plants, including complete data on source, size, quantity, and availability. Any substitutions of plant types, species sizes or quantity must be approved by the Landscape Architect prior to this time. If credits or deducts in the contract are required due to substitutions, the Landscape Contractor shall submit these with the materials list submittal.

C. Plant Photos and Specifications

The Landscape Contractor shall provide the Landscape Architect with photos and size specifications of all trees that are not previously tagged off by the Landscape Architect. These trees will be subject to approval by the Landscape Architect. Refer to legend for any other plants requiring photo submittal to the Landscape Architect. Photos shall be submitted to the Landscape Architect a minimum of 90 days prior to commencement of job.

D. Unit Costs

Within 30 days of signing the contract, the Landscape Contractor shall provide the Landscape Architect with an outline of the unit costs of all plant materials and other materials and products as specified. These prices will be the basis for determining additions or subtractions to the contract.

E. Time Schedule

Within 30 days of signing the contract, the Landscape Contractor shall submit a detailed schedule outlining the description of work and the dates for completion to the Landscape Architect, and the General Contractor for coordination of reviews and integration of other work.

PART 2 - MATERIALS

2.01 GENERAL PRODUCTS

The following material shall be used:

A. Topsoil: Contractor may use on-site topsoil, without admixtures of subsoil, free from rocks, sticks, or other foreign matter as a subsoil in all planters up to within 2" of top of curbs. Imported topsoil shall be fertile, friable local natural topsoil free from subsoil, clay, stems, roots, stones, weeds, and other debris. It shall be delivered in a workable condition. Imported topsoil shall be a minimum of 12" in depth and shall be held 2" below the top of the curbs (for a finished elevation) in all planting areas.

B. Soil Amendment: Nitrohumus or acceptable substitution.

C. Granular Fertilizer: Agriform 16-7-12 + iron or approved substitution.

D. Tablet Fertilizer: Agriform 20-10-5, 21 gram planting tablets or approved substitution.

E. Mulch: Turf and Tee or acceptable substitution.

F. Stakes for Trees: As shown in the details.

G. Pre-Emergent Herbicide: Treflon, Dymid or acceptable substitution.

H. Cactus Soil Mixture: Cactus soil mixture shall be used only in specified areas and shall consist of: 2 parts builders sand, 1 part pea gravel, 1 part "Nitrohumus," 1/2 part "Perlite." Verify with Landscape Architect.

1. This mixture to be used for all planter tub soil mix to be planted with cacti and all planting areas contaminated with building materials during construction. All tainted soil shall be removed from the site and replaced with this mixture. Mixture shall be installed a minimum of 18" deep.

2. Existing soil not contaminated during construction, as determined by the Landscape Architect, is approved for cacti and succulent planting.

I. Plant Materials:

1. Quality and sizes: Plants shall be vigorous and of normal habit of growth and shall be free of disease, insects, eggs and larvae. Plants shall equal or exceed the standards as outlined in the California Association of Nurserymen, and applicable California State Codes.

a. Nursery grown: Plants shall be nursery grown under climatic conditions similar to those in the locality of the project.

b. Pruning: Plants shall not be pruned prior to delivery except upon special approval.

c. Ground cover plants shall be rooted plants grown in flats or containers as specified.

d. Inspection: Plants shall be inspected and approved by the Landscape Architect at the site upon delivery. Such approval, for quality, size and variety shall not preclude the right of inspection and rejection at the site during progress of work, for the size and condition of root balls, latent defects or injuries.

J. Tree Root Barriers

1. Deep Root" control barriers or approved equal available at Deep Root Corporation (213) 390-1060.

PART 3 - EXECUTION

3.01 PLANTING INSTALLATION

The following planting installation procedures shall be followed, and no planting shall be done during unfavorable weather.

A. Rough grading and topsoil

1. Remove all growth of vegetation, debris and stones larger than 1" in diameter from all areas to be planted. Work in topsoil as required.

2. Cultivate planting area to 6" depth, and grade so that finish grade is 1" below adjacent paving or 2" for shrub beds.

B. Soil preparation:

1. Spread 2 cu. yards of soil amendment and 12 pounds of commercial fertilizer per 1000 square feet in all planting areas except cacti/succulents and cultivate to depth of 6" in two directions, so additive is uniformly mixed. Water shall be applied if necessary, to bring soil to ideal moisture content for tilling and planting.

C. Staking:

1. Plant locations as shown on drawings shall be staked out and approved by the Landscape Architect before any installation begins.

D. Tree and shrub excavations, or "plant holes" shall be square, with vertical sides as indicated on the details.

1. Place plant in pit centered, upright and faced to give the best appearance or relationship to adjacent plants or structures. Roots shall be placed in their normal position, and plant shall rest on solid soil to such a depth that the finished grade level at the plant after settlement will be the same as that at which the plant was grown. Add prepared backfill around the plant and compact carefully to avoid injury to the roots and fill all voids. When the hole is 2/3 filled, add water as necessary for settlement. Repeat the operation until the soil level is at the finish grade of the plant.

2. Form a temporary shallow saucer or dyke around each plant of sufficient size to allow thorough watering if plants are to be hand watered until the irrigation system is operational, add a 2" layer of soil amendment and lightly cultivate into the soil as a mulch.

3. Bare root cacti or succulent roots shall be treated with sulfur prior to planting.

E. Ground cover areas shall have 2" of soil amendment thoroughly mixed and tilled into the top 6" of soil. Plants shall be evenly spaced in neat rows and not allowed to dry out. Upon completion of planting, they shall be kept watered with a fine spray only, and care shall be taken that the plants are not sprayed in direct sun.

F. Landscape Contractor shall meet with the Landscape Architect prior to planting to establish correct planting procedures. This includes: plant care, handling, damage (replacement and guarantees), soil preparation, root pruning, irrigation system, initial watering, and watering schedules. This is critical for palms and cacti/succulent planting.

G. Provide Stakes and Tree Guards and Root Guards as shown in details or as directed by the Landscape Architect.

H. Watering: Plants shall not be allowed to dry out before or while being planted. Water plants immediately after planting, and thereafter until acceptance of work. Refer to item L for cacti/succulents.

I. Remove all containers, boxes, straps, non-essential stakes, trellises, etc. from plants and remove from site.

J. Treat all planted areas, gravel, and rock/cobble areas with pre-emergent weed agent per manufacturer's specifications.

K. Apply 1" of specified mulch to all planting beds except "raked earth", decomposed granite, or "cobbled" areas.

L. Verify the soil amending, watering, and fertilizing of all cacti and succulents with the Landscape Architect prior to planting.

M. Plants that show signs of failure to grow, or injured plants shall be replaced immediately.

3.02 MAINTENANCE

A. A preliminary inspection by Landscape Architect to determine the condition of plants will be made when all plants have been installed, and Landscape Architect will indicate acceptance in writing at that time.

B. Upon approval of the above, the 90 day maintenance period shall begin. This shall include weeding, cultivating, fertilizing, pruning, and watering as necessary to maintain plantings. Protect plantings against damage including erosion. Contractor shall not be held responsible for acts of malicious mischief.

C. At the conclusion of the 90 day maintenance period, a final inspection shall be made for final approval. All ground cover areas shall be treated with pre-emergence weed killer at beginning and end of the maintenance period.

D. Replace all dead and missing plants.

3.03 GUARANTEE AND CLEAN-UP

A. All plant materials shall be guaranteed for 90 days from FINAL ACCEPTANCE date. Boxed trees shall be guaranteed for (12) months. All plants not in vigorous growing condition including ground cover, as determined by the Landscape Architect, shall be replaced immediately.

B. The entire site of the work shall be kept clean at all times. Upon completion remove all excess soil, stones, debris from the site and leave in a well finished condition at the close of the job.

END OF SECTION

SECTION 02990

LANDSCAPE ACCESSORIES – DECOMPOSED GRANITE

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services for all landscape accessories, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. Work to Include:

1. Selection and placement.

2. Excavation, compaction and grading for placement.

3. Review by Landscape Architect of selection and placement.

4. Coordination with other trades.

5. Site storage of materials.

C. Related Work:

1. See Section 02810 - Automatic Irrigation System.

2. See Section 02900 - Landscaping.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Decomposed granite color and quantity as indicated on drawings.

B. Soil treatment with pre-emergent herbicide: Surflan, Diazanon, or acceptable alternate.

PART 3 - EXECUTION

3.01 GENERAL

A. Treat soil with pre-emergent herbicide at decomposed granite locations as directed by Landscape Architect.

B. Landscape Contractor shall be responsible for supplying all decomposed granite as shown on the plan. Landscape Architect will review and accept these materials prior to delivery to the site.

C. The Landscape Contractor shall be responsible for:

1. Selection and placement of all decomposed granite used on site.

2. Any excavation and fine grading necessary to set the decomposed granite.

D. The decomposed granite shall be installed at a minimum depth of 1 ½" over a smoothly graded compacted soil subgrade. Once the decomposed granite is spread in a uniform manner to a consistent depth, it shall be thoroughly watered to wet the full thickness of the decomposed granite and compacted to form an even solid cover.

3.02 CLEAN UP

A. Provide clean up and off-site removal of any unused material.

B. Coordinate work with landscape contractor.

END OF SECTION

DIVISION 3
CONCRETE

SECTION 03000

CONCRETE - GENERAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services for all concrete work as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. Definition:

1. Concrete work: Cast-in-place structural concrete for use in buildings, paving, and appurtenances. Specific aspects of concrete work are specified in other sections:

   a. Concrete Formwork: Section 03100.

   b. Concrete Reinforcement: Section 03200.

   c. Cast-in-Place Concrete: Section 03300.

   d. Concrete Mixing, Placing, Jointing and Curing: Section 03310.

   e. Concrete Finishing and Repair of Surface Defects: Section 03350.

2. Acceptable or permitted: Accepted or permitted by Architect.

3. Exposed construction: Exposed to view.

4. Exposed to public view: Situated so that it can be seen from eye level from a public location after completion of building. A public location is accessible to persons not responsible for operation or maintenance.

5. Normal weight concrete: Concrete for which density is not a controlling attribute, made with aggregates of types covered by ASTM C33, usually having unit weights in range of 135 to 160 PCF.

6. Required: Required by Contract Documents.

7. Submitted: Submitted to Architect/Engineer for review.

8. Other words and terms used in these specifications: As defined in ACI SP-19.

C. The provisions of these specifications govern wherever applicable to conditions and types of work that occur on particular job except as otherwise provided in Contract Documents. In case of conflicting requirements, Contract Documents govern.

D. Design criteria:

1. CBC, (California Building Code) latest edition.

1.02 JOB CONDITIONS

A. Do not allow construction loads to exceed superimposed load which member, with necessary supplemental support, is capable of carrying safely and without damage. Amount, method of distributing, and proposed supplemental support of loads during construction is responsibility of Contractor.

1.03 PLACING CONCRETE

A. Notify Architect minimum 24 hours prior to commencement of concreting operations, to allow for visual review of reinforcing.

B. Install vapor barrier under interior floor slabs on fill. Lap joints minimum 4 inches and seal. Do not disturb vapor barrier while placing reinforcement. See section 07110 for vapor barrier.

1.04 CONCRETE MIX

GENERAL:

A. Mix concrete in accordance with ASTM C94.

B. Foundation Concrete:

1. Compressive Strength (7 days): 1500 psi
2. Compressive Strength (28 days): 2500 psi

3. Slump: 4 inch maximum

C. Slab on grade:

1. Compressive Strength (7 days): 1500 psi
2. Compressive Strength (28 days): 2500 psi
3. Slump: 4 inch maximum

D. Curbs and Gutters Concrete:

1. Compressive Strength (7 days): 1500 psi
2. Compressive Strength (28 days): 2500 psi
3. Slump: 4 inch maximum

1.05 TESTS

A. Submit proposed mix design of each class of concrete to Architect for review/approval prior to commencement of work.

B. Three concrete test cylinders will be taken for every 75 or more cubic yards of each class of concrete placed each day.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all formwork as required, as indicated, in accord with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. See Division 1 for General Requirements.

B. Use forms, wherever necessary, to confine concrete and shape it to required dimensions. Use forms of sufficient strength to withstand pressure resulting from placement and vibration of concrete, with sufficient rigidity to maintain specified tolerances.

C. See concrete finish requirements in Section 03350.

D. Use earth side forms for spread footings, pile caps and unfinished grade beams where earth can be shaped to a straight and true surface. Comply to earth side form detail on structural drawings.

E. Design and engineering of formwork, as well as its construction, is responsibility of Contractor.

1. Shoring and reshoring shall be designed and sealed by a Professional Engineer, currently registered in California, and having experience in this work.

2. Design formwork for loads, lateral pressure, and allowable stresses outlined in ACI 347. Formwork design shall also satisfy applicable requirements of the local building code.

3. Develop shoring and reshoring pattern and sequence so as not to exceed safe structural capacity of supporting structural systems.

1.02 TOLERANCES

A. Construct formwork so that concrete surfaces will conform to tolerance limits listed: All tolerances non-cumulative.

1. Variation from plumb:

   a. In the lines and surfaces of columns, piers, walls, and in arrises:

      (1) In any 10 ft. of length (1 in 500): 1/4"

      (2) Maximum for entire length: 1".

   b. Variation from level or from grades specified:

      (1) In any 20 ft. length (1 in 1000): 1/4"

      (2) Maximum for entire length = 1/2".

2. Variation from level or from grades specified:

   a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores.

      (1) In any 10 ft. of length (1 in 500): 1/4"

      (2) In any bay or in any 20 ft. length (1 in 750): 3/8"

      (3) Maximum for entire length: 3/4"

   b. In exposed lintels, sills, parapets, horizontal grooved, and other conspicuous lines:

      (1) In any bay or in 20 ft. length (1 in 1000): 1/4"

      (2) Maximum for entire length: 1/2"

3. Variations from true plans of concrete surface exposed to view caused by bulging of form facing material between supports:

   a. 3/16" or 1/300 of the span between supports whichever is smaller.

4. Variation of linear building lines from established position in plan and related position of columns, walls, and partitions:

   a. In any bay: 1/2"

b. In any 20 ft. of length (1 in 50): 1/2"

c. Maximum for entire length: 1"

5. Variation in sizes and location of sleeves, floor openings, and wall openings.

a. Plus or minus: 1/4"

6. Variation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:

a. Plus or minus: 1/4"

7. Footings:

a. Variations in dimensions in plan:

(1) Minus: 1/2"

(2) Plus: 2"

b. Misplacement or eccentricity:

(1) 2% of footing width in direction of misplacement but not more than 2".

c. Thickness:

(1) Decrease in specified thickness: 5%

(2) Increase in specified thickness: No limit (except that which may interfere with other construction).

8. Variation in steps:

a. In a flight of stairs:

(1) Rise: 1/8" plus or minus

(2) Tread: 1/8" plus or minus

b. In consecutive steps:

(1) Rise: 1/16" plus or minus

(2) Tread: 1/8" plus or minus